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Dr. Coleman at Mulberry Research Station

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The Mysore Agricultural Journal

(The Organ of the Mysore Agricultural and Experimental Union)

Vol. 30, April to June 1954, No. 2

IN THIS ISSUE

PROGRESS OF AGRICULTURAL ENTOMOLOGY IN MYSORE
ROLE OF PLASTICS IN PLANT CULTURE
IMPRESSIONS OF 4-H CLUBS OF AMERICA
CULTIVATION OF BAJE
GRAPE FLEA BEETLE
HYBRID FODDER BAJRA

The
Mysore Agricultural Journal

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(The Mysore Agricultural and Experimental Union does not accept responsibility for facts or opinions expressed by contributors.)

CONTENTS

PAGE

EDITORIAL 67

ORIGINAL ARTICLES

A Few of the Outstanding Events which have marked the Progress of Agricultural Entomology in Mysore—BY DR. M. PUTTARUDRIAH 70

The Role of Plastics in Plant Culture—BY M. R. ANANDA-RAMIAH 82

Impressions of the 4-H Clubs of America—BY H. HOMBE GOWDA 91

PAGE

Cultivation of Baje (Acorus calamus, *Linn.*) *in Mysore*—By R. S. Ayyangar 101

The Grape Flea Beetle, Scelodonta strigicollis *Mots. and Its Control*—By M. Appanna and B. M. Maheswariah 107

A Preliminary Note on Hybrid Fodder Bajra—By K. Gopala Iyengar and G. Srinivasa Iyengar .. 112

A Short Note on the Seed Rate Trials on Irrigated Hingari Jola (Sorghum vulgare) *at Siruguppa*—By S. B. Priyavratha Rao 115

SELECTED ARTICLE

Farming Fifteen Acres—By Clemens Pedersen .. 117

EXTRACTS AND SELECTIONS

New Light on Old Hariyali 123

Teosinte (Euchlœna mexicana *Syn.* E. luxurians) *Maize of Gods* 127

Seed-borne Diseases and Their Control 130

NEWS AND ANNOUNCEMENTS

Prof. P. C. Sarbadhikari 133

David Milne, C.I.E. 134

International Congress of Zoology 135

RESEARCH NOTES AND NEWS

Sugarcane Ratoons 135

Correspondence 137

Editorial

MARCH OF SCIENCE

Dr. Julian Huxley who was touring in India this spring delivered a very thought-provoking lecture on Evolution and Human Destiny in the Bangalore Town Hall on 23rd March 1954. The great biologist felt, that the even and sometimes slow course of biological evolution swerved significantly when Man emerged from the primates. With his capacity for thinking, his articulate speech, opposable thumb, erect posture and gift of passing on the social tradition to future generations, Man became able to change or influence, to whatever limited extent, the environment in which he lived. The Human Evolution became separate and different from the Biological Evolution and in Huxley's words "he became a sort of Business Manager of the Evolutionary Process" to control or guide it to suit his needs. This control and guidance may lead to the Oneness of Mankind, to the emergence of a World Religion based on science and reason or it may lead to destruction and desolation. But it cannot be denied that man has become master of his own destiny.

Till recently he was at the mercy of a host of pestilences and diseases—malaria, pneumonia, plague, tuberculosis and the like. Step by step he has learnt to control, if not eliminate them. The D.D.T. and other newer insecticides have already enabled him to blot out the scourge of malaria from many islands like Cyprus and Ceylon and in the near future we may expect our own *malnad* to be free from this debilitating and disastrous disease. During and after the Second World War phenomenal progress has been made in the study and development of antibiotics for the control of pneumonia, tuberculosis, etc. Three main groups of microflora—fungi, bacteria and actinomycetes are known to produce antibiotic substances which inhibit the growth of certain bacteria including some which cause disease. Man has been able to pit one group of organisms against another and control many diseases to which human and animal flesh is heir to. But there still remains diseases of plants which have got to be controlled or eradicated if the rapidly increasing human and animal population is to be adequately fed and protected: Insecticides and fungicides have helped greatly to check pests and diseases of plants but the

technique of biological control of pitting one group of living things against another has not yet been successful except in the case of some plant pests. But the search is on and the hunt is hot. For example, R. O. Lechance and C. Perrault have recently reported (*Canad. J. Bot.*, **31**, 5, 515 : 1953) that 19 bacteria and 11 actinomycetes showed some antagonism to the pathogenic fungus *Fusarium oxysporum f. lini* causing wilt of cultivated flax. According to a note in *Nature* (173, 4405, 617, April 3, 1954), "Six of the eleven actinomycetes had a fungicidal and five a fungistatic action on the *Fusarium* conidia. Greenhouse experiments have indicated that 15 bacteria and 11 actinomycetes offered a certain protection to seedlings some of which reached 6, 12 and sometimes 24" in height before showing any signs of wilting." Have we here, in these investigations, a promise of that future when man can control plant diseases by biological methods, injections of "antibiotics", etc. ? Who can tell ?

BICENTENARY OF THE ROYAL SOCIETY OF ARTS

Reference was made in the previous number to the sesquicentenary of the Royal Horticultural Society in March of this year. In the same month, on March 22, 1954, another great society celebrated its bicentenary. The "Royal Society for the Encouragement of Arts, Manufacturers and Commerce" to give its full title, was founded on March 22, 1754, by an obscure drawing master, one Willian Shipley, in a coffee house near the famous Covent Garden. This Society whose great achievements are little known in India, was either the forerunner, forbear or the foster parent of many great institutions like the Royal Academy, Royal College of Music, Institute of Chemistry, etc. Among its members were such famous names in literature, arts and sciences as Dr. Johnson, Garrick, Hogarth, Reynolds, Benjamin Franklin, Botanist Joseph Banks, and so on. It is said that Goldsmith was not only a member but at one time stood for its secretaryship.

We are told that the founder-drawing master was so absent-minded that on the day of his marriage he caught sight of a rare butterfly and ran after it, arriving late at the Church. The Society, like its founder, has been a quaint body of inspired amateurs in the fine British tradition of professional amateurish-

ness and disinterested public service. It is not, therefore, strange that the first two public lavatories in London were built by the Society (incidentally, the lavatory was used by only 38 people in one month).

During its long history it has encouraged such diverse pursuits as cultivation of potatoes, swedes, kale, knolkhol for feed and fodder, use of scythe instead the sickle, land reclamation afforestation, draughtsmanship, designs for wall papers photography, etc. In some of these pursuits and occupations it achieved notable results. It awarded 6 gold medals to a Colonel who is said to have planted 4,000,000 trees. It sponsored the great exhibition of 1851. It got up the first exhibition of photography ever held, and was the earliest to arrange large-scale commercial examinations. It held almost the first demonstrations in electric lighting, and gramophone. In spite of the fact that many specialist organisations have taken over the projects and programmes which the Society initiated or sponsored, the Royal Society of Arts continues to encourage arts, agriculture, manufacture and commerce by lectures, medals and awards and by the issue of the Society Journal. In recent years many famous names in agricultural science like G. V. Jacks and others have delivered lectures under its auspices. Dr. B. A. Keen's (now Sir Bernard) Cantor lectures in 1942, on "Soil Physics ; Theory and Practice", wherein he marshalled experimental evidence to shake our beliefs in the virtues of deep ploughing and frequent cultivations, has become a classic. Great progress was made from 1843 when the Prince Consort became President. Equally great progress may be expected now when another Prince Consort—the Duke of Edinburgh—has assumed the Presidentship of the Society.

The British are mighty proud of their traditions and institutions and it is this characteristic that has made them leaders in the fields of science, art and literature ; young and renacent India should take a lesson from them, preserve and be proud of our own great institutions like the Botanical Survey, the Geological Survey, the Pusa Institute, Bombay Natural History Society, Lalbaugh and the like.

A FEW OF THE OUTSTANDING EVENTS WHICH HAVE MARKED THE PROGRESS OF AGRICULTURAL ENTOMOLOGY IN MYSORE

By Dr. M. Puttarudriah*

The object of the cultivator in tilling and manuring the soil is to reap a rich harvest. To do so, it is necessary that he should not only assist the crops to grow, but must also protect them from the attack of insects and diseases. Every crop is subject to the attack of a score or more depredators. Every part of the plant as well as the harvested fruits and seeds and even the products manufactured therefrom are subject to infection and to partial or complete destruction. Many insects attack a great and an extensive variety of crops. With the change of environment minor insects become more destructive and major pests. They injure the crops and stored products in a variety of ways :—by chewing the foliage, stem fruit ; by sucking the sap of the plant, by boring into stems, fruits and roots ; by carrying organisms of plant diseases and in many other ways.

Several instances of insect havoc of major importance may be cited. Seeds sown are carried away by ants or affected by subterranean insects so that many a time necessity arises for resowing the fields. Cutworms are a serious menace to seedlings of kar ragi, pulses, cotton, tobacco, coffee and tea ; soil grubs to paddy, jola, sugarcane, vegetable and fruit plants. Stem-borers tunnel in paddy, ragi, jola, sugarcane and fruit plants. The grown up crop is attacked by grasshoppers, beetles and bugs of different kinds. In recent years paddy grasshoppers and jola stem-borer and earhead pests have become serious pests in Shimoga, Chitaldrug and Mysore Districts. Leptispa, a minor pest had assumed serious proportions in 1946 in the paddy areas of Malnad Districts. Stored grains and pulses are damaged by a variety of insects. Thus the pests of field crops and stored products levy a very heavy toll on the agricultural resources of man. The average estimated annual loss caused by insects only, the country over, is 10 per cent. of each crop ; it may be even more in some places for certain crops (Fig. 1).

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The Division of Entomology of the Mysore State Department of Agriculture is concerned with insect problems ever since its inception. The task of the Entomologist is very arduous. The insect problems are acute and difficult. He has been struggling hard against insects for the good of the cultivator. In formulating control measures against insect pests, the entomologist has got to study the biology and ecology of the pest to find out the vulnerable stage ; and consider the economics of the control measures, condition of crops, possibility or otherwise of the control measures. Before the results of his research are taken to the cultivator, he must test them in the laboratory and in the fields under varying ecological conditions, to find out the efficacy of the measures. With these difficulties it is not easy for him to hit upon easy and effective measures.

Even so, there have been many major achievements to the credit of the Division of Entomology. Several of the control measures are original and recommended for the first time by this Division (Fig. 2).

As early as 1902, the then Agricultural Chemist, Dr. A. Lehmann, realised the importance of insect pests and recommended the use of Paris Green against caterpillar pests, importing it for the first time in India, into Mysore.

The Division of Entomology was started in 1908 with Dr. L. C. Coleman as the first State Entomologist to conduct intensive research and devise suitable control measures against many crop pests.

Jola Grasshopper

During 1911, the paddy and the jola grasshoppers which were a serious menace in Malnad and Mysore Districts, and Chitaldrug and Shimoga Districts, were studied in detail and control measures like the bagging of the hoppers on the bunds was recommended. A suitable hopper dozer was specially devised to suit the field and soil conditions, which proved very effective in trapping the grasshoppers (Fig. 3). Control campaigns were organised against jola grasshoppers during the two cycles of outbreak—in 1926-34 and 1941-47. More recently dusting of bunds with sodium silicofluoride and later with 5 per cent. B.H.C. powder was investigated and found effective in killing the young hoppers on the bunds before they migrated into the fields. Use of poison bait prepared by mixing 1 part of sodium silicofluoride or B.H.C. powder or calcium arsenate with 8 parts

of wheat or rice bran and a little molasses and water just enough to make the mixture wet into a crumpling mass, was worked out and advised to the cultivators.

With the organisation of the Department of Agriculture in its present form in 1914, Dr. Coleman became the Director of Agriculture, and the entomological work was directed by Mr. K. Kunhikannan.

Coffee Greenbug—Fish Oil Resin Soap

Coffee scale insects like the green and brown bugs were studied in 1914. Fish oil resin soap, now sold extensively by the Madras Fisheries Department all over India and Ceylon, was prepared first at the instance of this Division and according to the formula given by it. It was first tested on the above scale insects and plant lice and other sucking insects, and recommended for general use by this Division, thus "providing a means of disposal of the fish oil for which there was at the time no profitable market".

Honge Oil Resin Soap

Further researches were made to substitute honge oil in place of fish oil, to prepare honge oil resin soap for controlling sucking insects. At the instance of this Division and according to the formula given by it, the Mysore Government Soap Factory at Bangalore has been preparing large quantities of this insecticidal soap since 1931, for the use of the cultivators.

Vegetable Fish-Poison Insecticides

During 1935-38, detailed investigations on vegetable fish poisons to make use of the toxic properties against insects, were made ; and the stem and root bark powder of *Mundulea suberosa,* a common forest plant was found to be a good preservative of stored pulses against pulse beetles, when spread as a thin layer on top of the grains in any receptacle. Extracts from seeds of *Tephrosia candida* a green manure plant was found to be as effective as nicotine sulphate which is a standard contact poison. *Derris elliptica,* an insecticidal plant of great value, was imported by this Division for the first time from Java and is now established in the State (Fig. 4).

Coconut Rhinoceros Beetle

Investigations on the attack of coconut trees by the *Rhinoceros* beetle were conducted during 1920-30. After studying its

bionomics, a cheap and efficient mechanical control by hooking the adult beetles in the holes and filling them up with a mixture of sand and salt was devised. In addition, control of the grubs in the manure heaps was found advisable. Recently it has been found that placement of 5 per cent. B.H.C. powder at the growing region of the plants and at the bases of fronds would ward off the beetles.

Red-headed Kamblihula

During 1920-33, red-headed kamblihula was causing a great havoc in devouring every kind of young crop in Kolar, Chitaldrug and Shimoga Districts of the State. The life-cycle and habits were studied and found that it was easy and cheap to collect the moths and destroy them. Campaigns for collections of moths in the affected villages during the monsoon months, organised by this Division with the help of the Village Panchayats of the area, and educational authorities in permitting the school children in the mornings to catch the moths for small payments, were very effective in checking the severity of the pest. In recent years dusting of 5 per cent. B.H.C. powder on kamblihulas has been found to be effective (Fig. 5).

Paddy Caseworm

Very early, even prior to 1920, kerosene treatment against paddy caseworm which regularly occurs in all paddy areas was worked out by this Division. It consists in placing a rag soaked in kerosene at the irrigation point of the paddy field for getting a film of kerosene on water all over the field. Then the plants are shaken by a long pole and the caseworms are made to drop on the kerosened water. This has been found to be very effective and has become a very popular remedy against caseworm and other external feeders on paddy.

Lantana Fly

For the first time in India attempts were made by this Division to introduce *Agromyzid* flies from Hawaii in 1921 and 1933 for the control of the Lantana scourge, which was accidentally introduced into India and has now become a serious menace to agricultural lands. The attempts were not successful. However in 1934 the *Agromyzid* fly was found to have established in Mysore and other parts of India, but it has not proved to be effective in destroying the Lantana weed. This problem is receiving the attention of this Division.

In 1923 Dr. K. Kunhikannan was appointed as the Entomologist, after his return from America, completing higher studies in Entomology.

Citrus Borer

During 1923-24, the large citrus-borer of South India was studied by this Division in Mysore as well as in Coorg and an effective, easy and simple remedy was devised. The affected twigs are removed during the months of June-July, and again in November-January, with the aid of a *long stick* ending in a narrow fork in which the twig is caught and given a sharp turn (Fig. 6).

Prickly Pear Control

Prior to 1927, prickly pear accidentally introduced into this country, had invaded thousands of acres of arable land in Mysore, Kolar and Shimoga Districts, and was fast spreading into other parts. In that year this Division imported the cochineal insect from Ceylon, tested it, mass-reared and liberated in a few places. Very quickly the natural enemy of the cactus multiplied and spread to all the places and destroyed the impenetrable bushes of the weed, thus rendering the land fit for cultivation again. Today the cochineal insect is well established in the State and has kept the prickly pear under check (Fig. 7).

Bee-Keeping

From 1927 onwards, the Division also took up investigations in productive insects like the honey bee with the intention of making it a subsidiary occupation for the cultivators. The box hive was evolved and the natural colonies were successfully transferred into modern hives. During the period of 1927-45 when bee-keeping was in this Division, the bee-keepers in Malnad areas were persuaded to take up improved method of bee-keeping. Thousands of hives were introduced both in malnad and maidan districts. Training courses were held for the benefit of intending bee-keepers ; and several demonstration centres were established and propagandists were appointed to help the bee-keepers. A honey marketing co-operative society was established in Saklespur.

Sandal Spike Disease

From 1929-33, this Division was also engaged in the investigation of the probable insect vectors of the sandal spike

disease, which was causing great loss to the Forest Department. Several transmission experiments with the suspected homopterous vectors were made and an insect survey of the sandal trees was also made and the periodicity of occurrence of the sandal insects was definitely ascertained. But no definite results were obtained as by that time the scheme was terminated.

Avare Pod-Borer

The Avare pod-borer has continued to cause great losses every season. In 1929-30, a very simple remedy was worked out and demonstrated to the cultivators. It consisted in carefully rubbing off the eggs seen on pods early in the season. The village children could do it easily every morning. The researches in this connection were continued and during 1946-48 biological control was investigated and attempts are now being made to rear the parasites of the borer in large numbers in the laboratory for releases in the field during the season.

In August 1931, on the sad demise of Dr. K. Kunhikannan, Mr. T. V. Subramaniam was appointed as the Entomologist.

Epilachna

Epilachna pest had assumed serious proportions on potato, brinjal and other plants in Bangalore and Kolar Districts during 1933-35. Spraying of lead arsenate mixture against the pest was popularised among the cultivators, who have now taken it as a regular measure of control when the pest appears. Later calcium arsenate has been substituted in place of lead arsenate.

Cockchafer Beetle

In 1933-34, Cockchafer beetle was found to be a serious pest of sporadic occurrence damaging the roots of sugarcane, potato, vegetables, seedlings of fruit and flower plants ; and plantation crops like coffee and areca. They were controlled by treating the soil with carbon-di-sulphide emulsion, which is now replaced by 5 per cent. B.H.C. powder incorporated into the soil.

Sugarcane-Borer Control (Figs. 8 and 9)

During 1934, when sugarcane was introduced for the first time to be grown in Mandya area much against the wishes of the cultivators, the havoc caused by the stem-borer was so

great that the crop was lost to the extent of 60 per cent. and the situation was alarming. It looked as though whether sugarcane cultivation was possible at all in the area. The existence of the sugar factory depended upon the successful cultivation of the cane. By then, for a period of 3 years from 1931-34, this Division had investigated the possibilities of biological control against the borer, and tested the efficacy of an egg parasite, *Trichogramma minutum* Riley, in the fields. To meet the situation, a parasite rearing laboratory was established at Mandya in 1935 for rearing the egg parasite in millions on an alternate host—the flour moth eggs—and releasing in the sugarcane fields. The Division later developed the light earthing up of young cane to prevent the borer from boring at the base. By means of the egg parasite coupled with the cultural operation, and with the co-operation of the Mysore Sugar Company thousands of acres of young cane are protected every year from the ravages of the borer. The benefit derived by the liberation of the parasites has been evident in the increased tonnage of cane yield varying from 2-8 tons per acre.

In respect of biological control, this Division has been the pioneer and several research workers and entomologists from other parts of India had their training in the laboratory at Mandya in connection with parasite rearing. Parasites were also sent to several places outside the State for testing.

The three egg parasites of the sugarcane top shoot-borer are also being recovered and released back to the fields. A mechanical control has also been organised for the collection of moths and egg masses by village children for small payments, in order to educate the cultivators about the usefulness of this method. Investigations are being conducted on beneficial parasites of many other crops.

Jasmine Mite

During this year 1934, jasmine blister mite became a serious trouble-affecting jasmine plants in Bangalore and Kolar Districts. This mite has been found to damage cotton also, by causing white velvetty patches on the leaves. Dusting of foliage with fine sulphur powder—300 mesh was found to be effective in controlling the mite. All the flower gardeners have adopted this control measure.

Coffee Stem-Borer

The coffee stem-borer has been a serious pest, causing damage extending to several lakhs of rupees in the State. During

the coffee slump years of 1937-41, the borer havoc was so great that several estates were abandoned. The Division had conducted several investigations on this pest. They had found that swabbing of stems with 10 per cent. coal tar emulsion was found to kill eggs and young grubs under the bark. Scrubbing of the stems to remove the scaly bark and prevent egg-laying by the beetles during October-November months was advised to the planters. Bored plants had to be systematically removed before the close of September and burnt. A Pest Act was promulgated in the coffee areas in 1937 for a period of 6 months in the year, and is now being continued all the 12 months from 1940 onwards, for compelling the planters to remove the bored plants and burn them before the emergence of the beetles.

Coffee Berry-Borer

Investigations were also conducted on coffee berry-borer which was suspected to have been introduced into India in 1930, and it was proved in 1935 that this dreaded borer was not in existence on coffee in Mysore.

Tobacco Stem-Borer

Tobacco was encouraged to be grown on a large scale, as a cash crop, when the Mysore Tobacco Company was started in 1937. The stem-borer proved a nuisance to the young plants. At once its life-history and habits were worked out during 1937-38, and easy and simple mechanical operation consisting of splitting the gall on one side by a sharp knife and carefully pressing the sides of the gall between the thumb and forefinger, to kill the caterpillar inside, was devised and demonstrated to the cultivators. As prevention is better than cure, spraying of nursery with calcium arsenate mixture was also popularised (Fig. 10).

Cardamom Hairy Caterpillar

This is a cyclic pest on cardamom plants, said to appear once in 15 or 16 years, in *Malnad* Districts. The first outbreak was in Hassan District during 1922 ; then in Hassan and Chickamagalur Districts during 1938-39.

Contrary to this experience, the pest broke out again in 1947-48. Since then, the pest has been negligible. It broke out again in pest form during the winter months of 1953.

During its outbreak in 1938-39, investigations on the life-history and habits of the pest were carried out and found that

the caterpillar defoliated the shade trees as well as cardamom plants. These investigations revealed that a convenient and cheap measure of control would be to collect the pupæ which are easily made out among the debris at the bases of plants and destroy them.

Dusting of 5-7 per cent. B.H.C. on the congregating caterpillars in the sheltered positions—hollows and depressions of tree trunks, etc., has now been found effective in killing the younger stages of the pest.

A white fungus—a natural enemy of the caterpillars has been found to exert some control in the estates. Planters have been advised to collect such fungus-attacked caterpillars and disperse them in other pest-ridden areas.

In 1942, on the retirement of Mr. T. V. Subramaniam, Mr. B. Krishnamurti succeeded him as the Government Entomologist.

Jola Earhead Bug and Fly

The jola earhead bug and the fly broke out in 1944 in the jola-growing taluks of Mysore District and 70 per cent. of the crop was lost. No control was possible in that year as it was too late and the cultivators had to be recommended for a remission. From 1945 onwards regular control campaigns were organised with temporary staff for demonstrating dusting of the earheads immediately after they are formed, with soap and tobacco powder mixture. Suitable pole and basket dusters which could be easily made in the villages were designed and a large number of them were supplied to the cultivators. Later B.H.C. powders were substituted in place of soap and tobacco powders.

Jola Earhead Webbing Caterpillar

During 1950 the jola earhead webbing caterpillar which was till then a minor pest took to ragi earheads in the absence of jola and reached alarming proportions. It was spreading to the neighbouring Mandya and Hassan Districts. Effective control of the pest before it could devastate in many stacks, was made by dusting B.H.C. powders on the earheads.

This pest has now been seen to be spreading to Chitaldrug and Shimoga Districts. The cultivators have been warned

against the pest and are advised to thresh the earheads immediately after harvest, or stack them with B.H.C. powder dusting.

Paddy Leptispa

During 1946-47, under abnormal rainfall conditions, the paddy blue beetle—*Leptispa pygmœa*—a minor pest of paddy became a major pest and was about to cause severe losses in Malnad Districts. Kerosene treatment as in the case of paddy caseworm was found to be effective on this insect too. Large quantities of kerosene oil were made available to the cultivators for protecting the paddy crop, and demonstrations were made in all the affected places. Waste transformer oil from the Electric Department was also used for this purpose. Later B.H.C. powder dusting has been found to be very good and the cultivators are being advised.

Fluted Scale

From 1947-50, a survey of the fluted scale (a serious pest of citrus in California, U.S.A.) which was found to have been introduced into India, was undertaken at the instance of Central Government to study its incidence in Mysore. It had confined itself to casurina and a few other ornamental plants. To nip it in the bud, its natural enemy—*Rodolia cardinalis* Muls., imported by Central Government was released in several places in the State. The imported predator, together with the local *Rodolia* spp. beetles rendered effective check on the pest.

Groundnut Aphis

From 1948 onwards groundnut crop in thousands of acres in Chitaldrug District, particularly in Davanagere Taluk is being attacked by plant lice, with the result that plants get stunted and no nuts are formed. Timely dusting of 5 per cent. B.H.C. powder on the crop at regular intervals has been advised to the cultivators.

Mango Hoppers

The problem of controlling of mango hoppers which suck up the sap from flowers and make them shrivel was solved in 1949-50, by spraying D.D.T. 50 per cent. wettable powder at the rate of 1 lb. in 16-20 gallons of water. This has been demonstrated using a powder sprayer to the satisfaction of the orchardists.

Paddy Grasshopper

During 1949-50, the paddy grasshopper became a serious menace in Shimoga District. 10,459 acres of paddy crop were saved by dusting B.H.C. (hexyclan) powder, 45 tons of which were made available to the cultivators exclusively for this purpose. Rules were promulgated to compel the cultivators to protect the crop by dusting the insecticide.

Castor Kondlihula

From 1950, the castor crop in the State, particularly in Tumkur District is being damaged very greatly by kondlihula, the semilooper caterpillar. Several insecticides have been found effective on this pest. The cultivators are advised to take up spraying of calcium arsenate mixture, or D.D.T. 50 per cent. wettable powder at the rate of 1 lb. in 16 gallons of water, or dusting of 5 per cent. B.H.C. powder, immediately they notice the pest. Protective dusting or spraying is very necessary as the pest devastates very quickly. Hand-picking of the caterpillars in small areas and scattering of boiled rice on plants to attract the crows which devour the caterpillars avidly have also been found effective.

Guava *Kajji*

In 1951-52, the cause of the guava scab—kajji—was investigated and found that a bug, *Helopeltis antonii,* caused the punctures by piercing its beak for feeding on the sap of the fruits, and these punctures developed into the familiar warts or 'kajji', later. Spraying of D.D.T. 50 per cent. wettable powder at the rate of 1 lb. in 16 gallons of water, or dusting of 5 per cent. B.H.C. powder has been found to be quite effective on this pest. Several garden-owners have carried out this measure and are satisfied with the results.

Cryptolæmus Predator

In 1951, this Division discovered the ladybird predator, *Cryptolæmus montrouzieri* Muls., around Bangalore, for the first time in India. It is an Australian insect imported to California during 1892-93 to control the citrus mealybug which was about to destroy the citrus industry there. This useful predator is very well established in the State and has kept many species of mealybugs infecting mango, guava, citrus, flower plants, etc., under check. They were sent to Madras and Coorg

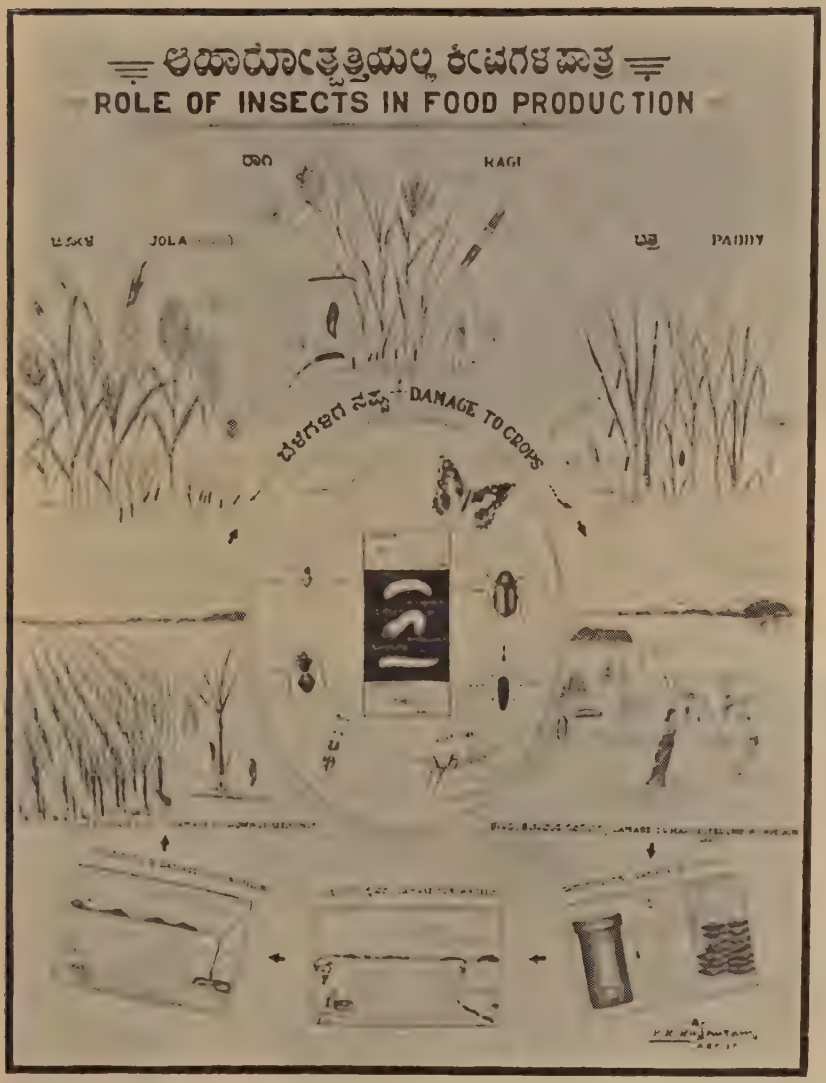

FIG. 1. Role of Insects in Food Production

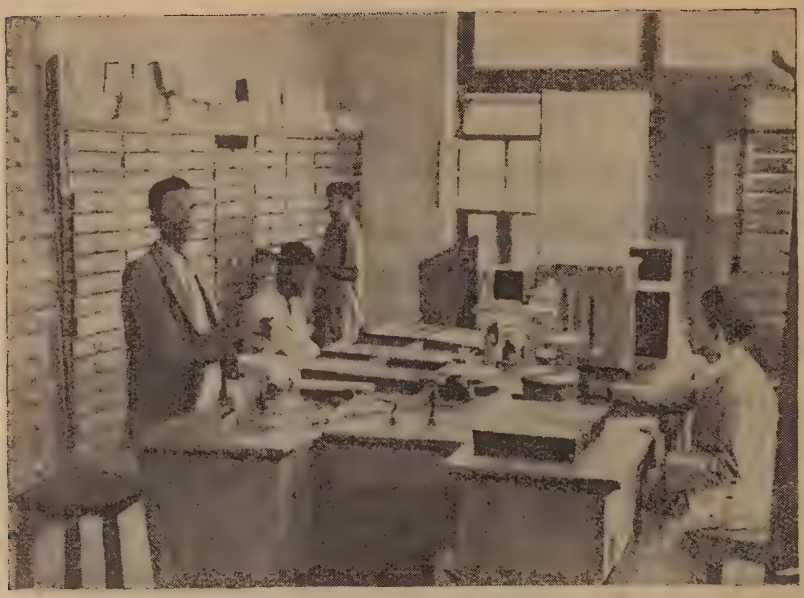

FIG. 2. Insectary views, with insect cabinets

FIG. 3. Trash Heap Method of sugarcane borer control

FIG. 4. Grasshopper bags at work in Jola fields

FIG. 5. *Derris elliptica*

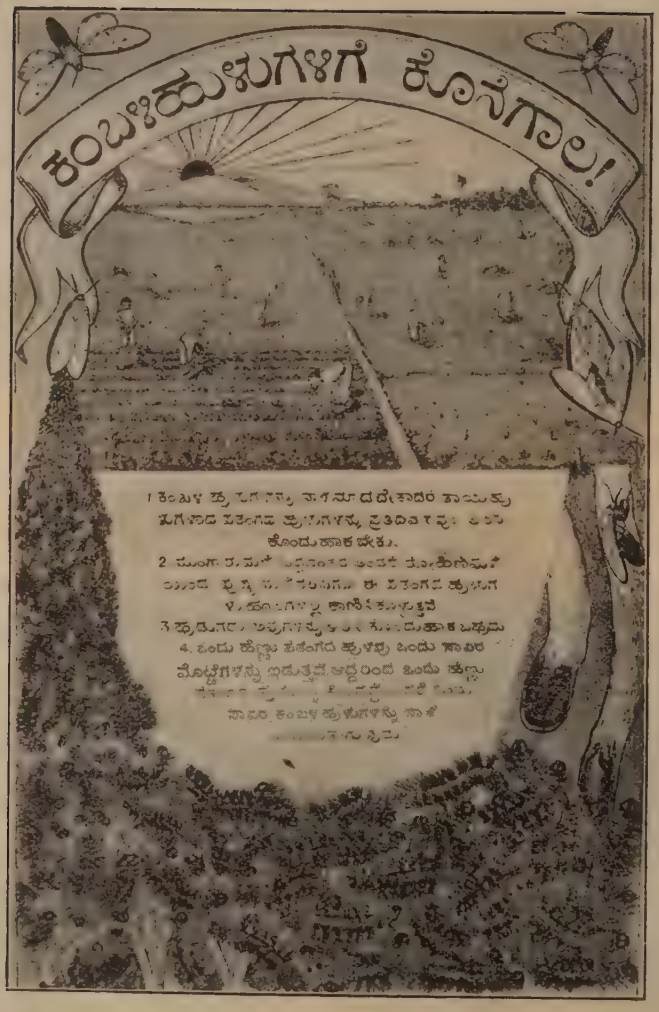

FIG. 6. Kambalihula campaign

FIG. 7. Removing twigs containing grub by means of a stick ending in a fork

FIG. 8. Cochineal Insect

FIG. 9. Biological Control

FIG. 10. Tobacco stem borer splitting

FIG. 11 (*a*). Some hand-operated sprayers and dusters

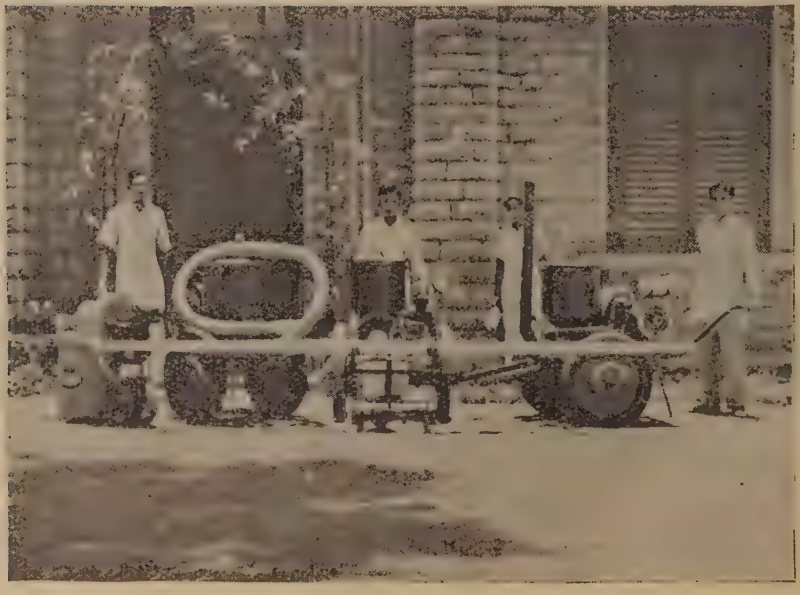

FIG. 11 (*b*). Power worked sprayers and dusters

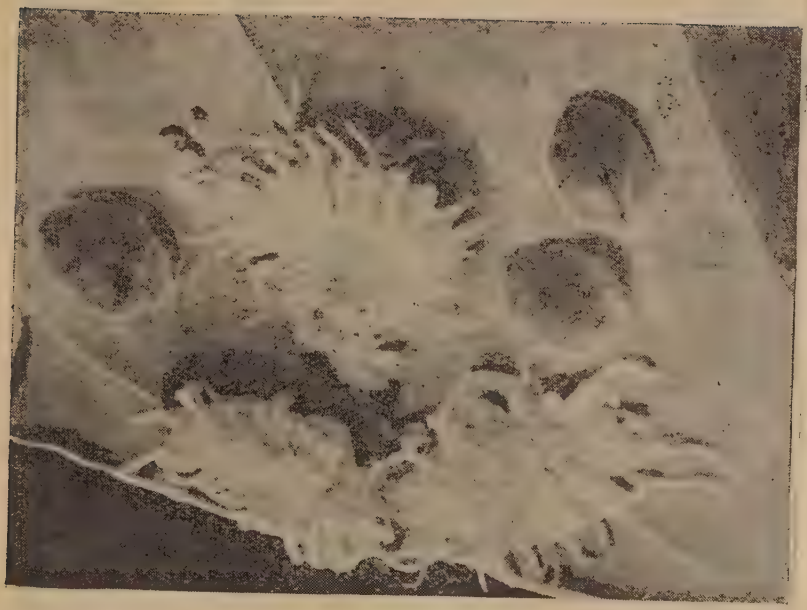

FIG. 12. *Cryptolæmus montrouzieri* Muls.

FIG. 13. Some of the beneficial predators being studied in the Entomology Division for use in biological control of insect pests.

States for colonising. A small unit was maintained to colonise the predator in places where it was not seen (Fig. 11).

In addition to the above, several other beneficial predators have been recently discovered and are being studied with a view to effect biological control of many other serious pests (Fig. 12).

Modern Insecticides

From 1952, several modern insecticides including the systemic insecticides and weed-killers, 2-4 D. compounds have been tested and the useful ones are made available to the cultivators.

Propaganda Work

A great part of the energies of this Division was taken up in demonstrating the remedies and in extensive campaigns. Several bulletins and charts and leaflets on the control measures of the crop pests have been published in English and Kannada. Popular articles on the subject are being contributed to the Kannada newspapers for the benefit of the agriculturists.

Plant Protection Service

Recently in 1948 a plant protection service under the guidance of this Division has been started for rendering immediate help to the cultivators in controlling more common and routine pests and diseases. Large quantities of modern insecticides with dusters and sprayers—both power-worked and hand-operated—have been made available to the cultivators (Fig. 13 A and B).

Conclusion

In conclusion, it may be stated that the war between insects and man continues and since the insects have a better possession of the field than the man, the entomologists should continue their researches for evolving better and easier methods of fighting them. The Division is continuing researches in studying newer pests in order to find out the vulnerable stage and hit upon easier and effective control measures. There is no final say in the matter of scientific problems ; and attention is continually paid to the above topics to improve upon what has already been done. The work in this Division is so much varied that all aspects of insect pests are studied so that they may be controlled by every method including the use of insect diseases as for example in the case of cardamom hairy caterpillars and coffee green bugs.

THE ROLE OF PLASTICS IN PLANT CULTURE

By M. R. Anandaramiah*

Ever since the cessation of the Second World War, a revolution has entered into the plant world. It is the widespread use of plastics in plant life. Extensive experiments have been carried out in various parts of the world including Arnold Arboretum (U.S.A.), Brooklyn Botanic Gardens (U.S.A.), Wisley Gardens in England and the Parks Department Nursery also in England, Aussie Experiment Station in Australia, etc., and amazing results have been claimed. Based on the results claimed elsewhere some experiments were conducted at Lalbaugh, Bangalore, regarding the use of plastics in gardening and the results achieved so far are remarkable and further experiments are still in progress. In some of the recent exhibitions held at Bangalore, the Horticultural Department demonstrated a few uses of plastics in plant life. This has roused a considerable interest among the minds of the amateur and professional gardeners which has resulted in a number of querries. The writer, therefore, desires to pass on to the readers of this Journal, information so far obtained from the experiments done at Lalbaugh and review the literature already published on this subject elsewhere.

Plastics

There are confusing number of plastic films now on the market. As all do not have the same properties for successful propagation it is important to obtain the right material. For the present two types of plastics material which are ideally suited for gardening purposes are available in the market. One is Vinylite plastic sold under the trade name of *Airwrap*. This patented plastic film contains green stippings and is coated with root-promoting hormones, vitamins and insecticides and fungicides. This is the material that is extensively used in America but unfortunately it is not available in the local market.

The other suitable material is polyethylene plastic which is identical with polythene or alkathene or visqueen sold in

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the market. This is manufactured by M/s. Imperial Chemical Industries (India), Ltd., and are available in several thicknesses but those ranging from 150-300 gauges are ideal for garden purposes. However no significant difference in the suitability of these thicknesses is evident. The cost is also very reasonable when compared with cloth. It is sold at the rate of Rs. 6 per lb., and 1 lb. measures about 12½ yards of 44" width—150 gauge. It is transparent, tough, resistant to chemicals, waterproof, grease-proof, not attacked by salt or salt water, resists bacteria and fungi and does not support mould growth. The strength of the film is not affected by humidity and has no tendency to shatter or becomes brittle. Further it is not dimensionally affected by changes in temperature or relative humidity and can be stretched tight around irregular shapes. It has a relatively sharp melting point and can be heat-sealed even with the help of a match stick. Being very low in water vapour transmission rate, this plastic film has exceptional qualities for retaining water vapour for a longer time and experiments conducted at Wisley have revealed that air layers with perfect end seals are kept moist for periods of upto 1 year in length. Besides, it allows for free exchange of gases without hindering the movement of carbon dioxide and oxygen gases. It is available both in sheet and tubular form and the latter overcomes one of the difficulties of the process of air layering which is to exclude air at the overlaps of the bandage enclosing the material round the stem thus leaving only the two ends to be secured by insulation or adhesive tape. Tubes 3-4" wide and 8-9" long make a good average size but have the disadvantage of taking much longer time to operate.

Propagation

The primary use of plastic film in the gardening world lies in the efficient and economical reproduction of plants. Cuttings or seeds now develop quickly under the influence of plastics. Besides plastics there are certain chemical substances called auxins or hormones by the use of which rooting can be accelerated. The use of such root-promoting hormones is also coming into prominence. There are several patented products available in the market in liquid, powder and paste form. For instance, Seradix (M. & B. Co.) exists both in liquid and powder form; Hortomone (I.C.I.) occurs in liquid form; Belvitan (Bayer) is available both in paste and powder form. However it is found that powder form of hormones lend itself more

favourably to the application of air layering. The other forms can be used easily for cuttings. The application of hormones comes in while polyethylene is used, whereas when *Airwrap* is used it does not need hormone application as it is coated with hormones for root-promoting. However, it is also possible to root without hormones but hormones help for quicker rooting.

The foremost use of plastics lies in the rooting of cuttings. In foreign countries sphagnum moss is used as the rooting medium while dealing with plastics but such a material is not available in our place, and so the ordinary rooting medium consisting of 1 part leaf-mould, 1½ parts red earth and 1 part sand has been freely used wherever rooting has to be done.

For rooting a few cuttings, a sheet of plastic film is folded around the rooting medium in which a cutting or a group of cuttings are nestled. The film is tied together near the base of the stem forming a small bag. This bag is kept under normal rooting conditions without further watering. As the plastic film is transparent, the roots emitted can be easily seen. Then the bag is untied and the cuttings are set out separately. By this method most of the herbaceous annuals and perennials can be readily rooted. Polyantha rose cuttings rooted in a record time in Bangalore by the use of this method.

When larger number of cuttings are to be rooted, to make the operation easy, simple and profitable, rooting is done by a method called "Roll method". By this method cuttings of woody plants, house plants, perennials like chrysanthemum, annuals like petunias, etc., can be rooted easily. The method is handy and a far greater number of cuttings can be rooted in a given area. Moreover, materials so packed can be shipped to distances without any extra care since the moisture losses are reduced to a minimum.

This method consists of laying a strip of film 6-8" wide and of a desired length on a table. Spread the rooting medium on the upper half of it and lay the cuttings on the rooting medium 1" apart. Fold over the lower half of the plastic and begin to roll from one end resulting in a neat, round package that stands by itself. No additional watering is needed until rooting. The package may be placed in good light and not in direct sunlight. Depending upon the nature of the cuttings, the time taken for rooting varies. On rooting, the package may be opened and the rooted cuttings set out separately.

It is a known fact that even hard-to-root cuttings can be made to root easily if sufficient humidity is provided. Based on this principle, Lewis F. Lipp, Propagator, Arnold Arboretum (U.S.A.) devised an easy, inexpensive propagation unit. The development of this unit, actually requires no attention once the cuttings are placed and this unit has the advantage of only one watering.

To set up the unit, select a pot or seed-pan or a wooden box generally used for sowing seed or inserting cuttings. Fill the container with rooting medium after providing enough drainage. If possible treat the cuttings with root-promoting harmones. Insert the cuttings in the container. Place a temporary frame of wire or bamboo stick around the edge of the pot or the box which is slightly higher than the level of the cuttings so as to leave some place above the cuttings. Then cover the entire unit with plastic making sure that it is tight. The plastic tent keeps in the humidity thereby creating conditions like those of a green house. But more important is that no further watering is needed for several weeks since very little evaporation occurs beneath the tent. Keep this unit in a semi- or dappled-shaded place because strong sunlight should be avoided. It is amazing how soon the cuttings will root, and once they are rooted, the temporary covering can be removed, leaving the rooted cuttings in the unit. The time taken for rooting depends upon the nature of the cuttings. Actually it has been proved so successful that even the most difficult woody kinds will respond in this unit.

The same unit can also be used for hastening the germination of seeds of woody plants, annual, perennial or vegetables, but it is especially good for seeds that need special care.

Air Layering or Stem Layering of Gootying or Marcottage

It is comparatively easy to propagate most of the trees and shrubs from cuttings but there are certain notoriously obdurate plants which are so difficult to root as to make the whole operation not only unprofitable but most impracticable. In such cases propagation by air layering is attempted.

Air layering was used by the Chinese 3,000 years ago and this ancient practice consisted in binding manure and moss to induce root promotion in plants which are difficult to root from cuttings. This is in constant use through the years chiefly as a means of propagation. The operation now in practice

being simple consists of a selecting a healthy branch with well ripened wood. At the desired place where it has to be rooted, either it is ring barked or a tongue is opened. The rooting medium is held in position round the part of the stem operated upon by a piece of gunny bag or cocoanut fibre or moss or bamboo receptacles or two halves of a 4" pot. The rooting medium is kept moist by applications of water constantly. At least twice a day it is to be watered for keeping moist. The sole success lies always in keeping it moist. Hence it is almost a very tedious process. To overcome this difficulty of watering gootying is generally done in rainy season. Whatever may be, it is an operation requiring constant attention.

The advent of plastic film has streamlined this ancient craft and it has become extremely easy and popular. It is gratifying to note that the use of plastics in air layering was first developed by Colonel William R. Groove in Laurel, Florida.

The operation is simple while using the plastics. Select young branches of reasonable thickness, say, $\frac{1}{4}$-3" diameter, remembering that these must of necessity vary according to the type of tree or shrub chosen to be air-layered. Remove the bark in the form of a ring one-and-a-half times as wide as the diameter of the branch itself, or make a cut $1\frac{1}{2}$-2" long in an upward direction at the desired place where it has to be rooted. The entrance of the cut should commence almost immediately beneath and to the side of the leaf-axil, leaving the axil on the tongue of the cut and a reasonable distance from the apex of the shoot. Care must be taken while making the upward longitudinal cut to make the incision penetrate almost to the centre of the stem. After the necessary cut has been made, a root-promoting hormone, preferably in the powder form, is applied with the help of a brush to the bare exposed wood in case of ring method or to both the cut surfaces and around the stem in the immediate vicinity of the cut. Further open the jaws of the cut by placing a small twist of clean moss or a pebble between the cut surface. Then sufficient quantity of rooting medium well moistened beforehand is placed all round the operated portion. This is then held in position with the plastic film which must be wound around the rooting medium in such a way as to arrange for the overlap of the film wrapping to be done on the underside of the air layer, thus preventing any water into the package. Then twist

the plastic film tight at each end. If the two ends are folded rather than twisted in the direction of the overlap this will prove a quick and easy procedure. Then the two ends may be tied tightly with the help of a strong string or rubber rings or they may be air-sealed with adhesive tape. While applying the tape care must be taken to continue the winding beyond the edge of the film to finish on the wood of the stem ; this prevents water running down the stem of the plant into the rooting medium. Should this be allowed to occur, numerous failures among the air layers will occur due to the soggy conditions inside the plastic wrap creating unfavourable rooting conditions. If the air layer is correctly done, it will remain moist and healthy, over a period of months, giving ample time for rooting to take place.

Success is always more when matured one-year-old wood is air layered especially during their growing period which generally happens to be in the rainy season.

As soon as it is considered that sufficient roots are formed to sustain the layer's independence, it should be removed by severing from the parent below the insulation tape. Then, while planting, simply untie the plastic and the insulation tape and insert in light soil. Roots will not be disturbed and plants do not suffer a set-back.

Crotons at Lalbaugh were ring-barked and air-layered with polyethylene plastic film without using any root-promoting hormones. They took 30-33 days to form sufficient roots when they were severed from the parent plants and inserted in sand after removing the plastic film. Similarly, well grown branches of Java fig (*Ficus benjamina*) with about 2" diameter branches were gootied without any harmones. They took nearly 40 days to give out sufficient roots. In the usual condition, crotons would have taken 2 months or more and Java fig would have taken a couple of months more than the crotons. Therefore the use of plastics for propagating Java fig branches has solved a great problem for us.

Plastics also come in handy for grafting. Experiments have been conducted by Lipp (Arnold Arboretum) and Palmer (Parks Department Nursery, Liverpool). Lipp took rooted cuttings of conifers and grafted them to the desired varieties. Then they were potted in individual pots in peat, and were rested on a layer of peat on the green house bench. Plastic

bags were placed over the entire pots. In 3 weeks the graft had calloused heavily during which time no water was applied.

According to Palmer, after the grafting was done, a piece of tubular plastic film 9″ long by 6″ wide was opened and carefully slipped over the scion until the lower end of the film came just below the base of the graft. It was then secured to the stock by binding tightly with adhesive tape. Sufficient moist sphagnum moss to cover the tongue of the scion and the top of the stock was then draped into the container thus formed, leaving the topmost 3″ of scion uncovered. Finally the top of the plastic film container was folded over and sealed with a strip of adhesive tape. After 10 days he found that union had taken place between the stock and scion, when the plastic was removed and the graft gradually hardened.

Plastic film can also be used to prevent moisture loss in potted plants. Regular watering practice for potted plant wrapped in the plastic sheet can be adjusted to suit the convenience of a family. Simply wrap a piece of plastic around the entire pot and fasten it at the base of the plant. This new approach to the problem of plant care has been very satisfactory, since the surface evaporation of the soil—a factor accounting for major water losses is checked due to moisture-holding capacity of the plastic materials. Therefore, those who have little time to water the plants every day and those who take a couple of days off, can make use of this practice.

Another important use of plastic is in the transportation of plants, seeds, bulbs, etc. Cuttings, rooted or unrooted, can be placed in moist moss and wrapped with plastic may be transposed to long distances. We had recently sent cuttings from here to Iran in the same way. The bulbs may be stored in plastics. Seeds can be packed in plastic bags and can be transported to any distance. Vegetable seeds received usually by this Department from Holland are always sent in plastic bags. The root system with the ball of earth well covered with moist moss over which plastic is wrapped can stand in a good condition for a fortnight without further watering. The writer has the experience of packing plants with moss and plastic and sending from Kemmangundi to Bangalore had reached in a perfect condition.

Yet another most important use of plastics is in the banana industry. Aussie (Australia) experiment reveal that plastic

covers for bananas improve quality. New South Wales Department of Agriculture reports that plastic banana cover is the most spectacular single development in the State banana industry and their findings indicate that fruit covered with plastic was far superior in appearance and quality to uncovered or hessian covered fruit. Eating qualities were excellent. Yellow, green and blue cover appear to be superior to white in that order of merit. It has been found now that plastic banana covers are extensively used in the banana plantations on Australia's subtropical eastern seaboard.

There are certain other garden operations wherein plastics are used. For instance, in the stratification of seeds, plastics play a great part. Stratification is a process where hard-coated seeds are treated to break their covering before germination is possible. Ordinarily this occurs in nature, but it can also be done artificially in order to plant the seeds when desired. The seeds requiring stratification are placed in plastic bags containing the mixture of sand or peat moss. Then these bags are placed under refrigeration for the required period of time. When roots show through the plastics, it means they are ready for planting.

Besides the above, there are numerous uses of plastics in plant life. Plastic sheets are used for covering newly seeded lawns, the advantage being that it permits light (needed by germinating grass) to enter, yet it retains moisture so that seed does not dry out. It is also used a winter mulch for covering the seed-bed as it is water-proof and unaffected by winter temperature. Green house growers use the sheets for covering the green house while applying fumigant soil sterilizers, and weed-killers. Used on the strawberry beds to protect plants from early frost. Used to maintain high humidity in cutting benches in place of customary glass enclosed cases. Thick plastic wraps can be conveniently made into pots. However their widespread use lies in packing vegetables, frozen foods, etc.

There is another plastic material sold as 'wilt-proof' which is becoming extremely useful in America not only for rooting cuttings but also in the successful transplanting of trees and shrubs. This is a milky liquid containing small particles of plastic which can be easily applied. When foliage is sprayed or dipped in this liquid, it forms a protective coating which becomes almost invisible when dry. Such leaves transpire much less and hence are less apt to wilt. Trees, shrubs or

cuttings treated with wilt-proof retain most of the vital moisture during the difficult period of rooting. However the plants require constant watering in the usual way.

Plastics, therefore, on account of their interesting qualities have become a popular feature of gardening operations. In these days of costly labour, such labour-saving techniques are to be welcome. However an earnest attempt should be made by every gardener with a view to making greater use of plastic film and similar modern materials in plant life.

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ANDHRA AGRICULTURAL JOURNAL

THE thirty-year-old *Mysore Agricultural Journal* heartily greets the *Andhra Agricultural Journal* which made its debut in January this year barely three months after the inauguration of the new Andhra State. The Journal which is published once in two months by the Andhra Agricultural Union (Agricultural College, Bapatla, Guntur District, Subscription : Rs. 6 a year) is edited by Sri. T. V. Reddy, B.Sc. (Ag.). Although the Journal follows closely the Parent *Madras Agricultural Journal* in lay-out, features, etc., it naturally and appropriately lays special emphasis on the development of the agricultural resources of the new State. We wish the Journal a long career of useful service.

FIG. 1. Gootee—Air layering, with plastics. FIG. 2. Plants prepared for air layering. FIG. 3. Pot covered with plastic to prevent loss of water by evaporation. FIG. 4. Rooting cuttings.

IG. 5. Roll method for rooting cuttings. FIG. 6. Propagation tent. FIG. 7. Materials required for propagation:—rooting medium, plastic sheet and knife, Seradix or other plant hormone, brush. FIG. 8. Propagation tent cover for seed pan.

IMPRESSIONS OF THE 4-H CLUBS OF AMERICA

By H. Hombe Gowda*

I.

The United States of America, a comparatively new country, is not merely the world's biggest industrial workshop, but is also in many ways an equally great agricultural testing ground where new ideas and new techniques are developed and brought into successful fruition. During the past three or four decades a great agricultural revolution has taken place in America and farming has become not only profitable to those who pursue it but also to the country at large. The new techniques have raised the United States agricultural potential to undreamt of levels ensuring for its citizens nutritive, delicious and abundant food. It has also enabled the United States to export huge quantities of foodgrains and cotton to feed and clothe the less fortunate peoples of the earth. How this country has been able to achieve such phenomenal results is an epic that every young farmer in India ought to know and, if fortunate, study at close quarters. No patriotic Indian can afford to miss the implications of the great and silent agricultural revolution that has taken place in the U.S.A. and the lessons that they teach for improving our basic occupation.

The U. S. agriculturists have shown how and what can be done to conserve and maintain the agricultural resources of the country at high levels of production by soil, water and wild life conservation, by farm mechanisation, by evolution of excellent strains of agricultural crops, by exploitation of hybrid vigour as in the case of hybrid corn, by plant protection by efficient processing of agricultural products and by chemurgy, *i.e.*, utilisation of the by-products and waste products of the farm. The U. S. agricultural extension service has successfully translated the huge output of practical results of the labours of these agricultural scientists on to the farmers' fields by a co-ordinated network of extension agents. Agricultural theory has been successfully married to agricultural practice with results that the whole world is admiring. In this agricultural revolution the "4-H Clubs" and

* Farmer, Kattemalalwadi, Hunsur.

youth organisations have played a very notable and important part. The truth of the adage that the child is father of the man can be seen nowhere more clearly than in America where the young farmers trained in the ideals of the head, heart, hands and health of the "4-H Clubs" have contributed so much for the agricultural development of the whole country. A better motto than the "4-H Clubs" "To make the best better" cannot be thought of.

It is a privilege given to few to come into contact with these young spirits in U.S.A.

The period from 1900 to 1910 was a period of growing rural prosperity in U.S.A. Farmers were not only making more money, they were emerging from frontier isolation. The years following 1900 marked the great campaign to pull rural America out of the mud.

All of these factors aroused in the farm people a dream for a fate better than lonely thankless and unrewarding life of hard work. Comparing themselves to city folks, they too wanted to live better with all comforts for themselves and their children. Farmers were beginning to realise that the small schools for which they paid taxes were not preparing their children for life on the farm but leading them away from it.

So they felt the need to train children for a job instead of only teaching them the traditional 3 R's. Dr. Liberty Hyde Bailey, the famous American agriculturist, through his nature study leaflets explained how unrelated was their teaching to the daily life. He said, "There is as much culture in the study of beetroot as in the study of Greek roots". Bailey's work encouraged educators to teach rural boys and girls to accept the challenge of the life around them. That in essence is what the "4-H Clubs" do today—to accept the challenge of the New Age.

In many places, many men and women were trying to improve the one-room schools of rural America. The birth of "4-H Clubs" therefore has no specific place or person to its credit. As many exceptional people undertook programmes of work they had little idea that what they were doing would some day lead to a great educational movement.

Anyway, two persons deserve mention as the pioneers in this movement, Albert B. Graham, a School Superintendent in

the State of Ohio, and O. J. Kern, another School Superintendent in the State of Illinois.

They started clubs for interested boys and girls. At this stage the agricultural experimental stations were looking for ways of getting their new-found knowledge out to the farms. These clubs became links between research stations and farms. These youngsters were supplied with the knowledge and material from the research station to compare the performance with the kind grown by their parents. Gradually projects were added to these boys and girls, for example, a vegetable garden for boys and a flower garden for girls. These home projects attracted not only more and more youngsters, but created an interest throughout the township. The foolish notion, "If my son can't be anything else, he can be a farmer", passed away. Gradually this enabled the introduction of agriculture to rural school curriculum and the farm boys and girls were becoming the object of attention of "Land Grant Colleges". These pioneers who worked with rural boys and girls formed clubs, were further encouraged by the report of President Roosevelt's County Life Commission which declared the farmers' social rights. The Commission pointed out that in the field of rural education the country school was not related closely enough to the boys' and girls' environment. It emphasized the need for a practical education in farming and home-making and called for increased extension activity on the part of the colleges.

Projects like the production of corn, raising animals and growing vegetables and flowers, canning fruits, etc., were given to these youngsters and prizes given to the winners. The public-spirited citizens provided the prizes. Excursions to colleges and farms and picnics were held often. This idea gradually pervaded the whole nation and took its roots in most of the States by 1910.

The rapid growth of these clubs demanded help from Washington. So the Washington Office of Farmers' Co-operative Demonstration Work selected O. H. Benson as the agent in 1911 for this work. He said that education for leadership must be along the lines of "4-H Clubs" rather than 3 R's suggesting that the "4-H Clubs" stand for head, hands, heart and hustle. Hustle was later replaced by health. The head was to be trained to think, plan and reason, the heart to be kind, true and sympathetic, the hands to be useful, helpful and

skilful, the health was to resist disease, enjoy life and make for efficiency.

This was the beginning of the emblem of today's "4-H Clubs" of America. The emblem consists of a four-leaf clover with a 'H' on each of the leaves.

In 1914, the Smith Lever Act was passed and the extension work and club work got the Federal aid. This act actually gave a fillip to the full growth of the "4-H Clubs" as the authors of the Act were convinced that these clubs were the training grounds for democratic living and citizenship development.

The "4-H Club" is a big one ; it is U.S.A.'s answer to the needs of U.S boys and girls for encouragement in the performance of those worthwhile everyday tasks that make for better living and richer personalities. It is founded on the practical arts. It is rooted in the boys' and girls' environment. It wins its recruits by voluntary means. This has proved to be a powerful educational concept. Club work in U.S.A. is one of the most unique educational programmes. It is voluntary. It dignifies the homely practical arts of living, holding that scholarship can be applied to cooking and creative intelligence to tilling the soil.

Based on everyday farm living, club work today engages the enthusiastic attention of 2 millions and more farm boys and girls and 200,000 voluntary adult leaders. It is guided throughout the United States and its territories jointly by the co-operative extension service of the Department of Agriculture and the Land Grant Colleges.

Today "4-H Boys and Girls" brush their elbows easily with the city cousins and feel no different. They compare their future in farming with the city boys' future at a machine or behind a desk without a hint of inferiority. This was not true in 1900.

The objective of these clubs are :

1. To help rural boys and girls develop desirable ideals and standards for farming, home-making, community life and citizenship, and a sense of responsibility for their statement.

2. To afford rural boys and girls technical instruction in farming and home-making that they may acquire skill and understanding in these fields,

3. To give them an opportunity to learn by doing through conducting certain enterprises and demonstrating.

4. To develop in them a scientific attitude.

5. To train them in co-operative action that they may increase their accomplishments.

6. To arouse in them worthy ambitions and a desire to continue to learn in order that they may live fuller and richer lives.

7. To teach and demonstrate to them methods designed to improve practices in agriculture and home-making to the end that farm incomes may be increased, standards of living improved and the satisfaction of farm life enhanced.

The personnel that handle this activity consists of the extension officials, *viz.*, agricultural agents, home agents, 4-H club agent, and the adults of the community who are called local 4-H Club Leaders. The 4-H Club requires well planned team-work of members, parents and leaders with the member doing the job. The 4-H Club members are young people between 11 and 20 years of age.

Each member will choose a project which he or she likes, to be carried out after consulting with his parents and the local leader. The member is expected to complete the minimum requirements for each project chosen and keep records of the work done. These projects are exhibited in fairs and exhibitions. The members learn a great deal about his or her project by seeing his or her exhibit judged along with the exhibits of other members. Maintenance of the record is a very important feature and recognition is given to each member on the merit of the work done.

Parents help members to select the right projects, provide financial aid in starting projects, give encouragement and supervision with projects, but allow members to do their own work and help set standards of sportsmanship and honesty.

Parents' co-operation is spontaneous and the leaders in the presence of all members, discuss 4-H work with them, hold meetings in the homes of members when possible, arrange tour to all members' homes and seek their help in club programmes and special activities. Also credit is given for their help.

The members in addition to the completion of projects undertaken, are expected to carry out programmes in health,

safety, music, drama, enter speaking programme and take part in community and country events.

The club programme insists on definite goals for the year which is carried, through periodic meetings and participation in various activities. Thus the member has something to work towards, which indirectly promotes attendance, encourages preparation and creates wide interest and satisfies desire for adventure.

Recognition by way of awards is given to encourage members to do continued good work. Awards include Achievement Pins, Medals, State Honour Pins, etc. Outstanding members are selected to represent counties in State activities, and States in National activities.

So there is an earnest struggle for survival and recognition in a realistic competitive society.

II.

The National 4-H Club Foundation of America, a body representing all the 4-H Clubs in the country has instituted a scheme of training of young farmers across the oceans through the International Farm Youth Exchange Project which is dedicated to the belief that understanding is the foundation of world peace.

When I was selected last April as an erchangee to live with the farm families of America I felt rather exhilarated, for I would see a new country and a new people and learn many new things. When I finished my education in the Agricultural College, I made a decision which was not quite usual. I decided to be a working or 'dirt' farmer although I knew that farming was unremunerative and unrespected and I would lack the modern requirements for a decent living.

I travelled across the oceans and as the Statue of Liberty loomed in the horizon when I was nearing New York, I felt sure that I would see something different from what I had seen in my own country. There was glamour in the American cities. There were skyscrappers, army of automobiles, well-dressed men and women moving about with pleasant and smiling faces. But in spite of these scenes, I was restless. I was most eager to see the farmers of America, to observe their farming and way of life and to analyse my own decision to be a farmer in the light of my new contacts and experience. It

was after a week after landing that I, with four other Indian boys, was directed to go to the State of Kansas to live with farmers. Our train carried us through the cities of Chicago, St. Louis and Kansas City which stood as evidence of a prosperous and great State. The huge buildings, the beautiful highways, the fast-moving vehicles, and more than all, the well-built and well-clothed people gave a sense of feeling that we were in a great country. As our train pulled into Manhattan Station, there was a young man running along the platform to find us. He shook hands with us and led us to his car and told us that he was a 4-H Club agent. He drove us to a rest house where we spent the night. He said before taking leave of us that he would drop in at 7 a.m. the next day to take us to our families. Next morning he came at the appointed hour and drove us about 100 miles to our destination—a small town called McPherson. That was an annual day when all school children were celebrating their achievement. The car stopped in front of a small but elegant bungalow which was the community's 4-H Club building. The local club agent jumped towards us and got himself introduced to us and took us where there were a group of men and women and children. They comprised five families from different parts of the county. After introduction we shared pot luck with them and later they took us to their homes. My hostess said that she had decided to call me 'Pea' as I was lean and as she could not pronounce my name. I said O.K. Immediately each family took us differently to the parade where the youth of the community was exhibiting their talents. We enjoyed the show for a couple of hours and went back to the club house where we had a nice dinner. Then we departed to our respective farms. My host family comprised of four members, *viz.*, two parents and two children, a boy and a girl, both High School Graduates. Both of them were members of the 4-H Club. I was led to the room assigned to me. It was a nicely arranged room with easy access to the radio, telephone, etc.

As I saw the host and his son changing their clothes, I also slipped into work clothes and joined them. My host said, "You better take rest today". I said that I need no rest and followed his son. He went towards the pen of pigs. There were two very nice pigs which, he told me, were his 4-H animals. He started feeding those and others. From there I saw my host watering the chickens. Both mother and daughter were in the kitchen

garden doing something. I was observing silently for a while and they started asking my American brother as to his activities in the 4-H Club. He was a standing member of the Club for 10 years and that was the last year of membership. When he started as a member at the age of ten he borrowed $ 10 from his father to start his project of raising pigs. Within the course of those ten years, he had undertaken several projects like growing corn, landscaping, and raising pigs, etc. He had earned from his projects nearly $ 1,000 and had a cash deposit of $ 250 in the bank. By then it was 5 o' clock in the evening. Both of us walked into the pasture and called the cows into the barn. There were six milking cows and that was done by machine milkers. I got the milk measured and it was 60 gallons. We chased the cows again into the pasture and took the milk in and separated the milk in a separator. It was 6 o' clock when we all washed and took our seats at the table for supper. The father said "thanks" as we meditated silently. Then we ate the supper which was highly sumptuous and nutritious. The father, mother and daughter started cleaning up the dishes. The son got up and said, "Hombe, if you want you can come with me—let us feed the pigs". We both carried the skimmed milk and fed the pigs. We entered the home again. I was told that we were visiting some neighbours. We all washed and the mother hurriedly got an iron and pressed my wrinkled suit. We drove about 5 or 6 miles ; we talked a lot about India and myself.

Before going to bed I asked when they were getting up in the morning. They said that they would start milking exactly at 5 o' clock, but I could sleep till breakfast is ready. I got up at 4-30 a.m. and got ready to join the father and son in their work. They expressed that there was no need for my staying up and they could do the job. I wanted to work and learn. I started working, I handled the milking machine, I carried the buckets of feed for the clickers, cattle and pigs. We had our breakfast and went out to harrow the young corn. At 9 a.m. the Agricultural Agent was on the air with his routine weekly talk to the farmers. I heard him talking about the infestation of pastures by certain grasshoppers and precautions to be taken against them. That afternoon I joined a group of 4-H boys and girls for tour to their homes. It was a very interesting feature. There were about 25 members and they all had about 15 different kinds of projects. Each member, when the group went to his home, had to give a complete record of his project and

answer questions from his group. I learnt thus a lot of details on 15 projects which impressed me very much.

Next day was a Sunday and they had to go to the Church. I was surprised to see the father polishing my shoes. He too was surprised when I protested. When we went to the Church the whole attention of the congregation fell on me. They were all very anxious to talk to me and hear me. I spoke to the youth on my own religion and reserved my general talk to the congregation for the next Sunday. In the afternoon lots of relations dropped in to have company with us and it was really a pleasure and embarrassment to see that so many people were so much interested in us and our country. That evening we had an outing to see a baseball game which is their national game. Gradually the relationship with the family became intensely affectionate and my hosts became Dad and Mom to me. Even today they address me as "My dear son".

From Monday onwards I had closer contact with the three officials of the county—the Agricultural Agent, the Club Agent and the Home Demonstration Agent. These three officials were always at the service of the farmers. The Agricultural Agent kept the farming community posted with latest information on farming, marketing, etc. The Home Demonstration Agent worked with the farm wives. The Club Agent guided the farm youth on their projects, etc. I attended many meetings of farmers' organisations and observed them discussing their professional problems. They have a network of organisations which find expression through their Federal units.

I lived with seven families in different parts of the country and studied them and their farming problems at close quarters. They all meant it when they accepted me as one of their children. Tears were shed when we had to part. These farmers had all the knowledge and all the desire for fuller living. This was the result of their training they had as youth. They were trained in building up their morale, character and sincerity which animates them today to be first-class farmers. Today's 4-H-ers are tomorrow's farmers. Farming in America is just a profession as remunerative, respectable and respected as any other profession. The farmer has his own rights and duties. He believes that he has to work to live a fuller life. Work is really worship for him. Dignity of labour has no particular reference to any one profession. All professions are considered as equal and honourable. All these results are ensured by the

education and training that they get as members of the 4-H Clubs.

What we need today is a lead from the privileged. If we want democracy to mean anything, let us educate the rural youth. If the farmers are happy, democracy succeeds. Only the informed people can be a free people.

I have come back with a greater pride in farming and a greater conviction that my decision to be a farmer is a sound one. The same pride can be created among our rural folk if only we end their ignorance.

Tiny Chemical Factories

A PLANT is like a tiny chemical factory. It draws carbon dioxide from the air, water and minerals from the earth. From these raw materials by the process of photosynthesis and using sun's energy for power the plant manufactures chemical compounds such as starch, sugar, fats, proteins, vitamins, etc.

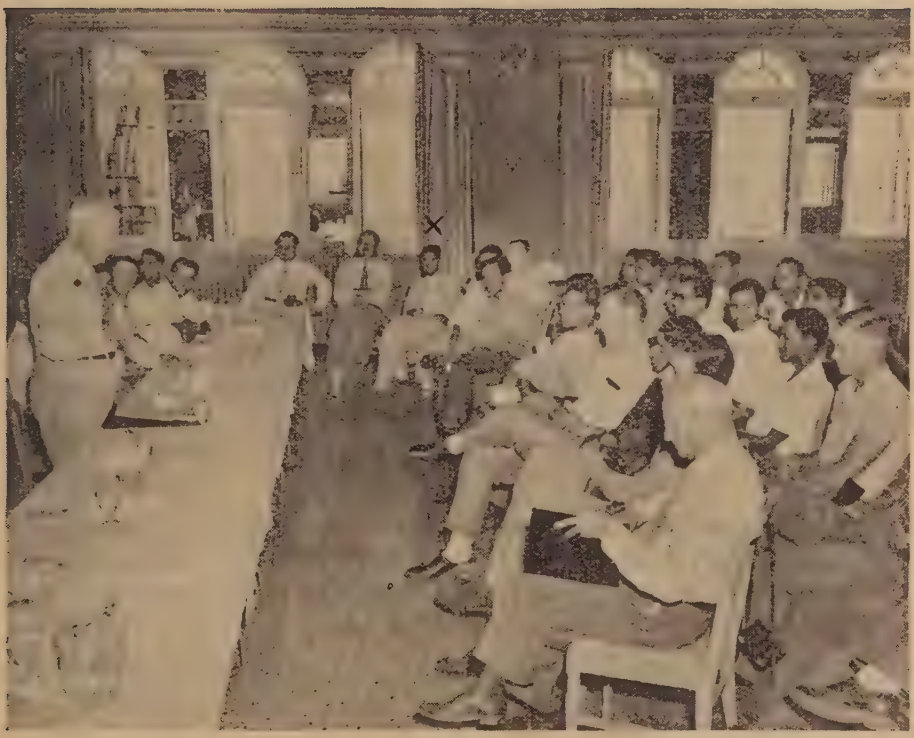
It is estimated that these tiny botanical chemical factories called plants over all the world produce around 200,000 million tons of such materials. But for producing this the plants use less than ½ per cent. of all the sunshine falling upon the growing plant though it is capable of using as much as 30 per cent.

Eggs and More Eggs

EGGS are high in vitamins A, B_1, B_2 and D. They also contain such necessary minerals as iron, phosphorus and calcium. But fortunately for those who must lose their weight the average-sized egg contains only about 79 calories.

Manure

MANURE produced by a dairy cow in a year averages about Rs. 150 worth of nitrogen, phosphorus and potash according to an Illinois expert.



Milburn L. Wilson, the then Director of Extension Work, United States Department of Agriculture, addressing the exchangees from India. The author Sri. Hombe Gowda is facing the camera (×).

CULTIVATION OF BAJE (*ACORUS CALAMUS*, LINN.) IN MYSORE

By R. S. Ayyangar*

Baje is known in the English-speaking world as sweet-edge or sweet-flag. It belongs to the natural order Arbideæ[1] and is found throughout the temperate zone. It is a marsh plant and so it grows in proximity to water or even in standing water.

The plant is a herbaceous perennial with long-branched rhizomes or rootstalks (as they are popularly called) creeping in the mud, about ¾" in thickness with short nodes and large brownish leaf-scars. The leaves are tufted, flat, sword-like, sweet-scented, 2-3' in length, and about 1" wide, closely arranged in two rows as in the true flag. The tall-flowering stems (scapes) which much resemble the leaves bear an apparently lateral blunt tapering spike-like cluster (spadix) of densely packed, very small flowers. A long leaf (spathe) borne immediately below the clusters form an apparent continuation of the scape, though really a lateral outgrowth from it, the spadix being the terminal. The rhizomes—the root stalks yield the drug "calamus". Variegated forms are cultivated for ornamental purposes.

Forms of Acorus are found growing of their own accord near pools of water without being attended to, even in tropical and sub-tropical countries. Thus it has a wide range of distribution. It is only in a few places that it is grown as a cultivated crop.

In Mysore, it is grown round about Koratagere—a town 16 miles from Tumkur occupying a small extent of land in the villages of Agrahar, Ajjihalli, Beldara, Bukkapatna, Vaddarahalli, Kalluguttarahalli, Navalkurike, Belaveeranahalli, Thorinakere, Mallekere, Thumbadi, Mavthur and a few other places. The total extent of land under this crop is about 300 acres all confined to Tumkur District.

Though a perennial in nature, still in the handling of this crop, it is treated as an annual planting and harvesting being done year after year. It is grown under the same conditions as *Nati bhatta* (transplanted paddy).

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1 Also called Araceæ.—*Ed.*

Its introduction into the paddy fields dates back to about a hundred years by one popularly known as Baje Channabasappa. He is said to have noticed a few of these plants as water weeds near the waste weir of the Agrahar tank close to the Agrahar village in Koratagere Taluk. He tried to grow them in his backyard in standing water. Having met with success, he grew them in his paddy fields. Since then it has become a permanent feature in the paddy fields. It is indeed difficult to say why its cultivation has not extended beyond the district to other parts of the State. Heavy cost of cultivation and lack of export market may be some of the causes.

Plentiful supply of water, as rainfall or irrigation, is what the crop needs. In fact it enjoys to grow in standing water. It does not stand extremes of temperature, 50-90° F. seems to be the optimum range. Since the summer temperature goes high, the crop suffers. To avoid this, the crop is harvested before the severity of summer is felt. In Mysore, it is 11-12 months crop, though the crop could be kept on for another 3 or 4 months if water facilities exist. It is usually planted in March and harvested in January and February. It can, however, be planted all round the year and can be harvested by the end of the first, second and third year.

It grows on a variety of soils. Sandy loam to clay, loam to clay loam soils rich in organic matter which could be puddled and water impounded easily are by far the best. It is the firm belief of some of the *baje* growers that the same land should be put under *baje* year after year. According to them the leaves and other parts of the *baje* plant that remain over when the crop is dug out gets incorporated into the soil and make the land particularly fit for *baje*. The popular saying is ಅದರ ಗರಿ ಅದಕ್ಕೆ ಬಿದ್ದರೆ ಹುಲುಸು ಜಾಸ್ತಿ.

The method of cultivation is mostly akin to *Nati bhatta* or transplanted crop of paddy. Being more or less an aquatic crop the field has to be prepared in such a manner that water could be easily impounded during the growing period of this crop. Most of the operations are done in puddle. The field meant for *baje* is impounded with water and when the land is in condition, ploughed 8-10 times with the country plough or twice or thrice with the iron plough. Those who use the country plough have necessarily to work the cultivator. Most of the *baje* growers are content to use the country plough. They plough the land 4 times and allow about 2 weeks' time and

again plough the land thrice and leave for a week and again the land is ploughed thrice, 50-60 bundles of partially withered *honge*[2] twigs are trampled in with the help of manual labour. After a week or so a plank harrow is worked and the field is made ready for planting.

The growing ends or tops of the previous crop of *baje* form the planting material. They are carefully collected during harvest and preserved. These tops will have a short length of about 1½-3" of tender rhizomes with half-a-dozen roots attached to them. The tops can either be planted at once or kept covered with dry leaves, straw or sugarcane trash for 15 days or so without any deterioration or being damaged. They could be kept much longer in open pits well moistened. Just before planting the leaf-blades of the tops are nipped to reduce their length and are taken to the field for planting. Water is let out of the fields before planting. The tops are tried into small bunches and are placed in the field at 1½ yards apart. The bunches are untied and the individual tops are planted at 1' apart in rows and 1' between rows in "scissor" style. The root end of the tops are pressed into the mud allowing the growing end to be well above the ground. They are planted slantingly in such a way that they slope in the same direction as the flow of water so that they may not get dislodged as irrigation water rushes into the plots. About 32,000 tops would be required per acre. Tops from 1 acre of *baje* field provide enough planting material to go for 2 or 2½ acres. Sometimes when they want to extend their area under *baje*, more than what the tops of their previous crop can present, they withhold water for about 1 month when the crop is about 2½ months old and then irrigate the field and as a result they produce 2-3 side shoots or suckers called *Mallepairu* (ಮಲ್ಲೆ ಪೈರು). These suckers are separated and used for planting purposes. Rhizomes too could be used for planting but they do not do it. Some growers have the impression that the crops raised by planting rhizomes produce thin rhizomes and will not be fit for marketing.

After the crop is planted, the field is allowed to go dry for a period of 10-15 days during which time new roots emerge. Thereafter watering is done continuously. In the first one month there will be an inch of water standing in the beds. From the second month to the end of the fourth month it is

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[2] *Pongamia glabra*.

increased to 2-2½". From the fifth month till the crop is harvested it is further raised to 4½". Care should be taken to avoid drying of the field while the crop is growing. It not only results in enormous weed growth but also the crop suffers. The main rhizomes suffer in length and thickness (they become short and thin) but instead several side shoots or suckers come up resulting in *Mallepairu* as stated above. Weeding is the main intercultivation operation. The crop receives in all, 8 weedings, *i.e.*, 1 weeding a month up to eighth month. Thereafter the crop itself smothers the weeds. There will be practically no space for weeds to grow. From then onwards instead of weeding, the principal operation in the *baje* field would be the removal of dry leaves. They are removed and trampled in the mud once a month from the eighth month onwards till the crop is harvested which may be in the eleventh or twelfth month.

The crop is sometimes top-dressed. About 3 months after planting, 40 md. of *honge* cake or 15-20 cartloads of farmyard manure is applied. Sheep and goat manures may also be applied. Cultivators believe that if fresh dung from the stalls are straight transferred to the *baje* field when the stalls are cleaned each day, the crop benefits much more than stored manure from compost heaps or pits. Artificial manures have so far not been tried.

Till about the fifth month the rhizomes run at a depth of about 2". Thereafter they get lifted and at the end of the sixth month they come to the surface. During the first 4 months, the green tops flourish ; thereafter the rhizomes begin to extend. They say ಬೆಳೆ ಸಾಗುತ್ತದೆ. By the sixth month rhizomes will be about 1¼-1½' and by the twelfth month they will be 2-2¼' and under favourable conditions of soil and water they may even be 8' long. Secondary growth starts from the sixth month onwards. It is most vigorous during eighth, ninth and tenth months. When the crop is 12-13 months the tops wither and the height of the plant falls. This is an indication that the crop is ready for harvest. Under cultivated conditions *baje* does not flower. *Baje* has a bunch of long wire-like roots. The roots are about 2' long. This makes harvesting operations difficult.

When the crop is mature which is indicated by the height of the crop falling and the tips of the leaves turning yellow harvesting is taken up. Field is drained and water is withheld and the field dried. When the soil is in condition to work *gud-*

dalies (hand hoes), the crop is dug out. First of all the growing ends are cut out and preserved for planting purposes. Then the dry leaves are pulled out and the rhizomes are exposed. The rhizomes are then pulled out or dug out with the help of *gud-dalies*. The long rhizomes are washed in water and mud sticking on to them is removed and the roots are cut into short lengths of about 2-3" and sun-dried. Weather conditions during harvest play an important part, for the rhizomes have got to be sun-dried. Some of the growers do not harvest the crop after 12 months. They allow the crop to grow for 3 years. This is not very desirable for they get no benefit. On the contrary, too many rhizomes develop one above the other and the underlying rhizomes rot or get spoilt in quality. Digging also becomes difficult for there will be many more roots than usual and they will all be firmly fixed in the soil. Harvesting is a difficult job and the men employed for this purpose are paid in terms of bundles they harvest. A bundle about 1/3 md. and Re. 0-8-0 are paid for harvesting 1 bundle. A man harvests 3 bundles and earns Re. 1-8-0 a day.

After the rhizomes are cut into short lengths they are dried in the sun. When they are three-fourths dry they are beaten with sticks to remove all the roots. This is repeated for 2 or 3 days. Then they are rubbed on the floor sometimes with fine grit or mud. This helps in removing the roots and leaf scars and gives certain amount of shine to the rhizomes. Two men can rub 2-5 bags of rhizomes a day. Each bag normally contains 3 md. Wages for rubbing and polishing 1 bag is Re. 0-8-0.

Yield of the crop varies considerably. An average crop yields about 150 md. A good crop may mean about 280 md. or more. If the crop is harvested at 8 months the rhizomes will be thin and the yield will be about 80 md.

Usually rhizomes are sold away immediately they are made ready for market. In the event of there being unfavourable prices, they are stored. They could be kept in gunny bags for 2 years without any much deterioration in quality. The prices have been fluctuating between Rs. 2 per maund in 1940 to Rs. 15 in 1944. The prices have come down and at present *baje* sells at Rs. 6 per maund.

Tumkur, which is on an average about 16 miles from the centres of production, is the chief market. Trading is done through *mandies* and *dalals*. *Mandies* receive the produce and

keep them for a week or so and auction them later to the highest bidder. *Dalali* or trade commission works out to 6 per cent. Transhipment from the field to the market is by carts and sometimes by lorries. Cartage works out at Re. 1 per bag of 3 md. Each cart can hold about 16-20 bags.

No rotation is practised. *Baje* after *baje* is the rule but sometimes paddy is rotated with *baje*. It permits of no subordinate crop. *Baje* is remarkably free from pests and diseases.

Though not a crop of international commerce, still it is a money crop and the produce comes to some of the local markets. *Baje* is used for various purposes. It is a common household medicine particularly for infants' ailment and hence it is called *Makkala thayi* (ಮಕ್ಕಳ ತಾಯಿ)[3]. It is an important constituent of various Ayurvedic medicines. It is a stomachic, tonic and astringent used in indigestion, flatulence, diarrohea and debility. It is used against bites of poisonous reptiles, foul breath and throat infections. Externally it is an insecticide and on account of its strong smell it drives away fleas, lice and vermin. *Baje* sticks or powder kept in bags containing cloth or books protect against silverfish, etc. It is reported in the village Agrahar which is the main centre of production, there has never been any case of plague and this is attributed to *baje* cultivation. It even goes into the composition of some of the face powders and is also used in the leather industry.

It costs about Rs. 150-200 to produce an acre of *baje* crop. Preparation for the market, transhipment and marketing charges come to about Rs. 100 per acre. Thus the total cost comes to about Rs. 300 per acre. The returns at Rs. 6 per maund for 150 md. comes to about Rs. 900. Thus it is a very paying crop. It is worthwhile to know why its cultivation should not be extended and to find out the various other uses to which this crop could be put to. It is reported that women are not employed for any part of *baje* cultivation. Even men work alternately. The men who work continuously are said to suffer from excess 'heat'.

In conclusion, I must thank Sri. K. R. Chandrasekhariah, L.Ag., Agricultural Extension Service, for having helped me in collecting information on *baje*.

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[3] Children's mother.

THE GRAPE FLEA BEETLE, *SCELODONTA STRIGICOLLIS* MOTS. AND ITS CONTROL

By M. Appanna and B. M. Maheswariah*

(Received for Publication on 12th May 1954)

Introduction

The cultivation of grape in recent years has aroused keen interest amongst agriculturists and orchard owners, mostly due to the increased income the crop fetches in the market. As a result, there has been a definite increase in area under this crop. In Mysore State, it is more intensively cultivated in Bangalore District, particularly the Taluks of Bangalore, Devanahally, Hoskote and Anekal than in the other districts.

The crop is usually attacked by the Flea Beetle—*Scelodonta strigicollis* Mots.—(Scelodontinæ, Chrysomelidæ, Coleoptera) —which assumes the status of a serious pest during certain years.

Occurrence and Distribution

Jacoby recorded the presence of this insect in India. Lefroy (1907) was the first to record this insect as a pest on grape vine. Fletcher (1914), Ramakrishna Ayyar (1923) and Ramachandra Rao (1930) have referred to this insect as a serious pest of grape vine in South India. Subramania Iyer (1921) observed this insect on grape vines in Mysore and added that this insect occasionally assumed the form of a serious pest. Pruthi and Batra (1938) have recorded this insect in the N.W.F. Province. Trehan and others (1947) state that this insect is commonly met with mostly in the central divisions (Nasik, Poona and Ahmednagar Districts). Thus it can be seen that this insect is present all over India, the intensity of its incidence varying from place to place. During recent years the insect is becoming fairly common and found in increased numbers in the vine yards in Mysore.

Host Plants

The insect has been observed commonly on grape vines, the adults being seen in large numbers. Fletcher (1919) states that this insect (adult) has been observed on mango inflores-

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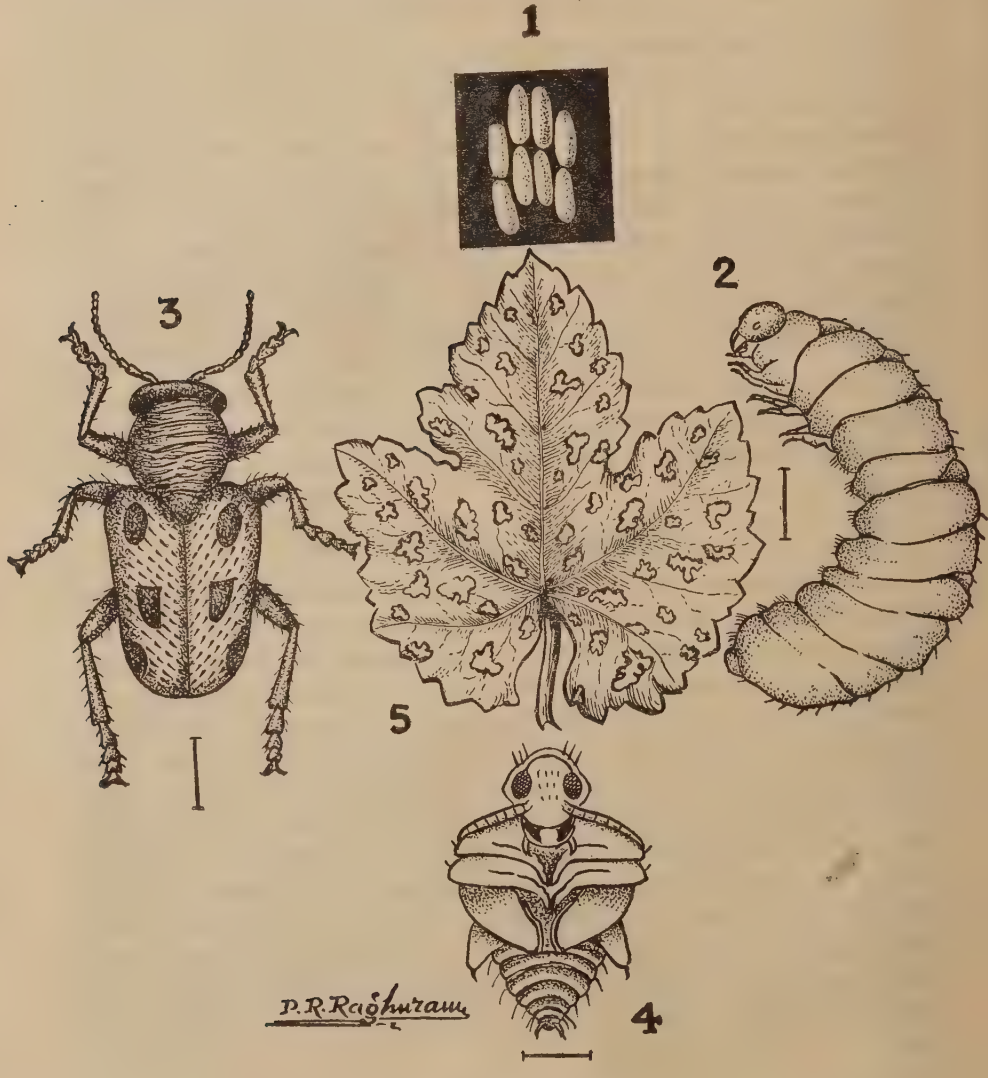
cence in Pusa (India) and on wild vitis in Minbu (Lower Burma). Trehan *et al.* (1947) has observed the adults to scrape the lower leaf-surface of *Erythrina indica*. In Mysore, so far, it has been a specific pest of grape vine.



Scelodonta strigicollis Mots.

1. Egg Mass (Magnified). 2. Full Grown Grub. 3. Adult.
4. Pupa. 5. Damaged Leaf with Punctures.

Life-History

Trehan and others (1947) have worked out the life-history of this insect in detail and the same is concised here for a

general knowledge of the life-history of the pest. Eggs are laid by the mother beetle under the bark and in crevices of the vines. The eggs hatch in about a week, the grubs fall to the basins or on the surface of the soil below the vines and burrow into the soil. They feed on the cortical layer of the roots. The grubs pupate in earthen cells and remain as such for nearly a fortnight. The adults emerge and feed on the leaves and tendrils. The average length of life-cycle is about 52-54 days (Trehan and others, 1947). The successive generations of the insect overlap ; thus it is possible to obtain the different stages of the insect at one and the same time.

The Adult and Its Habits

The adult is a small beetle with a coppery hue on the dorsal surface. There are six black markings, three on each side of the mid-dorsal line on the elytra. These markings are characteristic of this insect while the first and the last pair of markings are more or less oval, the central ones are triangular in shape with their apices turned towards the posterior end of the body. The beetles may be said to be gregarious in that they are found in large numbers together, though actual clustering or grouping, as the term indicates, is not seen. The adult feigns death when disturbed and remains motionless for a considerable time. It does not expose itself to direct heat or bright light and under such circumstances gets under cover of the leaves.

The Damage

The adult beetles are mainly responsible for causing damage to the crop, though reports are made that the grubs feed on the cortical layer of roots. It may be that the damage done by the grubs is insufficient. The adult beetles appear in large numbers, their main emergence synchronising more or less with the pruning season—April-May and October-November—of the grape vines. The adults feed on the first flush of leaves as well as attack the buds, thus forcing the vines to wither. In cases of very severe attack, the vines are reported to die. Even after the leaves have developed, should the beetles attack the vines, they feed on the leaves making several punctures in them and thus indirectly cause the reduction in the yield.

Control Measures

Various methods of mechanical control of the pest have been tried in different parts of India, mostly suiting the local

conditions. The most common method adopted is to trap the beetles with banan tassels. Trehan *et al.* have found that removal of loose bark of vines after April pruning reduced the number of egg masses on an average by 57-63 per cent. and that there was an ultimate reduction in the population of the beetle by about 42 per cent. In Mysore the general practice has been to tap the beetles by shaking the branches on to a sheet of cloth spread below the vines, the beetles being destroyed later. Use of stomach poison along with Bordeaux was tried by Trehan *et al.* They found that out of the several chemicals tried, Paris Green gave promising results. Dusting with the modern insecticides (D.D.T. and B.H.C.) has been tried in this Division. A mixture containing D.D.T. 50 per cent., B.H.C. 0·65 per cent. gamma isomer in the proportion 1 : 3 : 4 by weight was dusted in private garden on to infested plants which were just sprouting during May 1953. Observations made after 24 hours and 168 hours showed that the mortality was very high being 95-100 per cent. The dusted plants were not watered for 24 hours after dusting, allowing all possibilities for the emerging adults to get the contact poison which had deposited in the basin while dusting. There was no subsequent attack by the beetles and necessity did not arise for giving a second treatment. The yield was good. A crop which was lost was regained. During November 1953, treatment was given to large number of plants by private party. Instead of adding wood ash (exclusively for purposes of economy), the mixture was made up of D.D.T. 50 per cent. (Geigy Guesoral) and B.H.C. 0·65 per cent. gamma isomer (Hexidol 805) in the proportion 1 : 4, and it was observed that this treatment gave good results.

Summary

Scelodonta strigicollis Mots. has been observed to be a specific pest (so far) on grape vine. Its major emergence periods synchronise with the two pruning seasons—April-May and October-November—of the plant. The adults are mostly responsible for causing severe damage to the crop, in certain cases even resulting in the drying up of the plants. That the insect is a serious pest of grape vine is almost well established and necessary precautionary measures to control the pest well in time is of absolute importance. A mixture containing 1 part of D.D.T. 50 per cent. (Guesoral 550) *plus* 4 parts of B.H.C. 0·65 per cent. Gamma isomer (Hexidol 805) used as dust at

the time when the beetles make their appearance on pruned plants has given promising results in checking the pest. This mixture is intended to act both as a prophylactic and curative with residual effect against the insect.

ACKNOWLEDGMENT

We are grateful to Sri. B. Krishnamurti, Government Entomologist (on leave), for valuable suggestions and guidance. Thanks are due to Sri. P. R. Raghuram Pillay, Artist, Agricultural Department, for the diagrams.

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Insects

It is estimated that there are 10,000,000 different species of insects. About 700,000 kinds have been named and described. No one can even guess when the big tally will be finished. For such huge groups as beetles and flies (which comprise over half the world's species) an exact count may never be possible. In United States alone the economic loss from insects total at least $ 4,000 million (Rs. 2,000 crores) a year.

A HEN out of production for sometime and not getting ready to lay again soon may be recognised by the shrivelled scaly comb and wattles, small dry vent, hard abdomen and close setting public bones.

A PRELIMINARY NOTE ON HYBRID FODDER BAJRA

K. Gopala Iyengar and G. Srinivasa Iyengar*

In very many parts of the State, particularly in the irrigated areas, pastures are not only insufficient in area but are also of such poor quality that cattle cannot obtain by grazing sufficient roughage to maintain good health and condition. In such cases the cultivation of fodder grasses affords the best solution to the problem of finding necessary fodder for cattle. Good fodder grasses will provide very much greater weight of feed than could be obtained from the same area of land if it were used as a pasture.

By fodder grasses we mean those grasses which are specially grown and cultivated, which are cut by hand, and fed to cattle. As a class they are much taller and generally quicker-growing than pasture grasses. They are perennial grasses, which once planted, will continue to provide repeated cuttings for a number of years.

In tropics, the fodder grasses like Napier, Guinea, Elephant, etc., give the maximum amount of tonnage by producing tall clump-forming shoots. Of these the Elephant grass is the foremost, being hardy, vigorous, drought-resistant and with profuse stools. This has one great drawback, in that it produces coarse woody growth.

Among the cultivated fodders, jowar is the most important. It is quick-growing and produces a large quantity of straw in a fairly short period. This does not tiller and cannot land itself to repeated cutting. The other disadvantage with this edible-*cum*-fodder type is that the fodder cannot be harvested till the crop has headed due to the constant presence of hydrocyanic acid in the earlier stages which may poison the livestock. Further, on account of the exhausting nature of the crop, the yield of the subsequent crop is depressed to a very marked extent unless a very heavy dressing of the soil with compost is given for the succeeding crop.

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Sajje (Pearl Millet), *Pennisetum typhoides* is well suited for cultivation as a green fodder. It is quick-growing, with free tillering habit and in the case of some varieties the stems are very thin and succulent. It also lends itself to cutting more than once, as a large number of tillers spring from the stubbles. *Hullu Sajje* in which the stems are very thin is a good tillerer and the spikes are short and thin. This variety is largely esteemed as a very good green fodder. But, this variety is not very hardy and is affected severely by rust. Further, the power of regeneration tapers off suddenly after 2 or 3 cuttings and hence cannot be treated as a perennial.

To overcome these drawbacks a local race of *Hullu Sajje* (*P. typhoides* Stapf. and Hubbard) was crossed with Elephant grass (*P. purpureum* Schum.). The crosses were effected by the senior author during 27/30-9-1945 in the breeding cage of the Department of Agriculture, Bangalore, employing *sajje* as the female parent. Artificial method of pollination as well as the contact method was tried. The F_1 was raised during February-May 1946. These F_1s were intermediate in vigour between the two parents and were not markedly better in their stooling capacity. The spikes were imperfectly awned. The female parent was awnless. The hybrid plants though producing a profuse quantity of pollen grains, the setting of seeds was almost completely absent. Out of a total population of 18 F_1 clumps raised, only 2 spikes in which stray setting of seeds had occurred were obtained. The available seeds secured from the two spikes were utilized to raise F_2 generation. In the F_2 population, the setting of seeds though poor was comparatively better than in the F_1s. Subsequent generations were screened for vigour, tillering capacity and improved seed setting. In the 8th generation selected plants were bulked and taken on to yield trials. These small-scale trials were conducted both at Hebbal and Visvesvaraya Canal Farm.

Results of these trials proved very encouraging—the yields amounting to over 20 tons per acre in four cuttings during a year (*vide* table at end).

In the bulk crop raised, the plants showed slight variations with regard to their habit and growth and also in their stooling capacity, as could be seen in Fig. 1. Owing to this, the yields obtained have been comparatively low. In Fig. 1, the second plant from left is almost similar to the female parent—*Hullu Sajje.*

During August 1951 two distinct types A and B were isolated and tested. The first clump to the right in Fig. 1, typifies type B. A 90-days crop of type B, photographed just before harvesting can be seen in Fig. 2 and has given an yield of 13·2 tons to an acre. In Fig. 3 a young crop of type A is seen.

Type A.—Vigour moderate, tillering profuse, slow growth in the initial stages, highly leafy, ratoons well, severely infected by rust, yields less than type B.

Type B.—Vigorous, tillering moderate, rapid-growing, stemmy, ratoons moderately well, affected by rust to a lesser degree than A, yields heavily.

Further work is in progress.

Yield of green growth per acre

Hebbal—planted on 13-2-1951—Type A

1st cutting	24—5—1951	6·6 tons
2nd ,,	3—8—1951	4·4 ,,
3rd ,,	1-11—1951	2·4 ,,

Hebbal—planted on 12-5-1951—Type B

1st cutting	8—8—1951	13·2 tons

V. C. Farm—Bulk—planted on 15-6-1951

1st cutting	2	months after planting	5 tons
2nd ,,	4	,, ,,	8 ,,
3rd ,,	7½	,, ,,	8 ,,
4th ,,	11	,, ,,	6 ,,
5th ,,	13½	,, ,,	5 ,,

FIG. 1. Variation in hybrid bajra. Clumps of F. 9 generation.

FIG. 2. Standing crop of hybrid bajra, 90 days old. Type B.

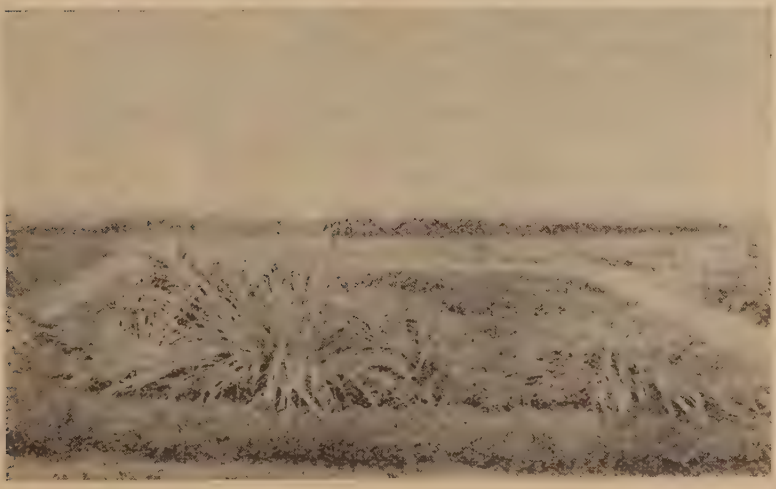

FIG. 3. Hybrid bajra. Young crop in nursery rows Type A.

A SHORT NOTE ON THE SEED RATE TRIALS ON IRRIGATED HINGARI JOLA (*SORGHUM VULGARE*) AT SIRUGUPPA

S. B. Priyavratha Rao*

The main crops raised in the Ceded Districts are jola and cotton. To recommend a scientific cropping pattern to the Tungabhadra Project raiyats, various crops including cotton and jola were tried both in the *mungari* and *hingari* season under irrigation. In the earlier trials at the Agricultural Research Station, Siruguppa, the *hingari* jola was not as much a success as the *mungari* jola under irrigated conditions. Causal factors for low yields in the case of irrigated *hingari* jola were investigated. One of the causes of poor yields in the *hingari* season was the high incidence of pests and diseases. One of the chief pests that is of regular occurrence and which causes great havoc is the jola shoot-borer fly pest, *Atherigona indica*. Trials with insecticides like BHC and DDT were conducted to combat the fly menace. Seed-dressing and spraying trials were done with the above pesticides. Seed-dressing treatments were not effective. In the spraying trials, DDT was ineffective, while BHC checked the fly attack to a fair degree. Large-scale spraying trials with BHC are now in progress to work out the economics of this treatment. Of the various other remedies tried to combat the fly pest, thick sowing and thinning of the attacked and unwanted plants at a later stage was the best.

The establishment of good and uniform stand is one of the prerequisites to obtain high yields. The jola fly pest attacked the young jola seedlings and this led to poor stand and finally to low yields. To find out the optimum seed rate for raising a successful crop of irrigated *hingari* jola in the black soils of the Tungabhadra Project area, a seed-rate experiment was laid out in 1952-53 with the following treatments. They are (*i*) 8 lb. per acre (control); (*ii*) 12 lb. per acre, (*iii*) 16 lb. per acre and thinning at the end of 4th week from the sowing date, and (*iv*) 20 lb. per acre and thinning at the end of fourth week from the sowing date. The above treatments were tested in two series in replicated and randomised plots. Two varieties (*viz*, Co. 9—a highly susceptible type to *Atherigona indica* and

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M.47-3- a fairly tolerant type to the fly pest) were used in this trial. The summary of results gathered in this trial are presented in the following table.

TABLE

Sl. No.	Treatments	Acre yields in lb.		Per cent. on control		Acre yields in lb.		Per cent. on control	
		Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
		(M. 47-3 series)				(Co. 9 series)			
1	8 lb. per acre (control)	866	2466	100	100	621	1341	100	100
2	12 lb. per acre	1159	2737	134	111	772	1619	124	121
3	16 lb. per acre and thinning at the end of the 4th week from sowing date	977	2479	113	100	649	1589	105	111
4	20 lb. per acre and thinning at the end of the 4th week from sowing date	917	2475	106	100	649	1599	105	112
	General Mean	980	2539	..	..	673	1537	..	..

The yield data gave conclusive results. The treatment with 12 lb. seed rate per acre was statistically superior to the other treatments, in grain yields, in both the series. The straw yield differences between the treatments under test were not significant. A conspicuous increase in grain yields ranging from 24-34 per cent. over that of the control by an increase from 8-12 lb. of seed rate per acre is noteworthy.

In the breeding area, at present, a seed rate of 15-20 lb. per acre is being adopted to combat the jola fly pest. This year's results in seed rate experiment have revealed that only 12 lb. of seed per acre is quite adequate to ensure the required healthy population for obtaining high yields. This being the first year of trial, the experiment will have to be repeated for another season before recommending this treatment for adoption in the Project area. Further trials are in progress on the Agricultural Research Station, Siruguppa.

Selected Article

FARMING FIFTEEN ACRES

By Clemens Pedersen

[Hard work and thrift are required in order to make a living out of 15 acres ; but though the Danish smallholder and his family are really hard workers, they are some of the happiest people in Denmark.]

Jens Hansen is a smallholder, a Danish "State" smallholder. He owns "a patch of his native land", as one of the favourite songs of the Smallholder Movement says. He is not one for keeping himself to himself, for shutting himself off from other people : he co-operates actively with his neighbours in many ways. But he finds the sure foundation of his happiness in his farm, which is his and his alone.

It is a small farm of some 15 acres of good farmed land. Denmark has many smallholders with smaller farms ; 30,000-40,000 have so little land that they are often called "cramped", and a few years ago special legislation was passed to provide them with additional land from large neighbouring farms, but this can only come gradually. Jens Hansen's holding is big enough to provide a living and full employment for him and his family. And that is the intention of the considerable funds which the Government makes available for establishing smallholdings by procuring land from larger farms and offering it for sale, and by advancing loans to enable smallholders to build and make a start.

Jens Hansen's property is free-hold and his farm is a real farm ; he does not hold with those who urge smallholders to convert their farms into market gardens for growing vegetables and such like. His farm, in the typical Danish way, is a general farm. He grows cereals, roots and grass ; and he does not sell the crops but feeds them to his livestock—the five red cows and three calves, the pigs, of which he has a dozen or so *plus* two sows with litters, the 150 fowls, and the two handsome little tawny horses.

Hard work and thrift are required in order to make a living out of it. In company with a neighbour, who has one horse, he owns a self-binder and at harvest time all three horses

are harnessed to it, but otherwise he manages all the haulage and fieldwork himself.

Root Crops Best

Jens Hansen's watchword is intensive farming: the best possible use of the land he owns, his stock, and his purchases of fertilizers and feeding-stuffs. He grows roots on about a quarter of his acreage; far more in relation to size than is customary on larger farms, for roots give more feed units per acre than cereals and grass, though they also mean more work. And he does not go in for swedes or turnips, but for fodder beet and sugar beet, which contain most dry matter. His grass fields are definitely not self-grown: they are some of his best cultivated acres. There is more clover in them than grass, because clover gives more feed units, and proteinous feed units at that; and they are ploughed up after a year or two so as to give maximum yield.

Hansen has a good mind to sow a patch of lucerne; the adviser of his smallholder society strongly advises this as lucerne give an even better yield. But he wants to think it over a bit first; he has so often seen other people's lucerne fields fail. A few years ago he had a silo built for silaging beet tops; in an autumn with an abundance of grass this also goes into the silo. It is a case of making the utmost use of the land and what it will give.

That is why Jens Hansen sometimes wonders whether he should replace his red cows with Jerseys. They are smaller and his wife Maren thinks that they are hardly real cows. But they eat less in proportion to their yield of butter fat.[1] Hansen's coarse fodder would do for six Jersey cows, which would give more and richer milk than the five red ones. It would most likely prove to be a wise move. Provided that people do not stop buying butter altogether.

Maren does not buy much butter for the family's own use. They eat margarine except on Sundays; it is cheaper. The milk is collected every morning by the co-operative dairy; when it is returned a few hours later the fat has all been removed and the remaining skim milk is fit for pigs and calves. It is fed to the pigs mixed with barley and oat meal, but Hansen sees that they also get some coarse fodder and the proteins and vitamins they need.

[1] Like our own cows!—*Ed.*

Cows and Pigs—The Main Interest

The cows and pigs are his principal source of income. From the dairy he gets a weekly sum which covers most of his current household and other expenditure. The co-operative bacon factory in the town pays a rather larger amount when a pig is delivered ; and provided only that he can buy coarse grain at reasonable prices his pigs mean as much to him as his milk. Pigs have been good business in recent years, thinks Jens Hansen, even though a good proportion of the payment received from the bacon factory goes to the co-operative feeding stuff society.

As a young man Hansen worked for farmers. His father was a smallholder before him, but young Danish farmers usually spend ten years or so working on large or medium-sized farms, where they both learn something about farming and are able to put a few thousand kroner by. Then Hansen spends six months at a folk high school and another six months at a smallholders' agricultural college ; and he regrets neither, though many people think that the smallholder college is enough.

When Jens and Maren got married he had not the means to buy a larger holding than the one he got and still has. Now he might manage to get himself a larger one if he wanted but he does not want one. On the whole, he is quite satisfied with his position. He does not envy larger farmers who complain that they cannot get work done because they cannot get the labour, and so often have to work harder than he does himself. True, they earn more money, but Jens Hansen does not do so badly.

He is his own master and he lives in the country. His children, two of them grow up in healthy surroundings and are well fed. His wife is a farmer's daughter and helps her husband with the day-to-day work on the farm, especially at busy times ; in the early summer when the root crops have to be thinned and weeded, at haymaking and harvest time, and in October when the beet has to be got in. Up to a few years ago she used to do the milking, night and morning, but since they got the milking machine Jens has done this. The only permanent "outside help" she has are the poultry. Receipts for eggs go a long way towards paying for the groceries from the co-operative store and clothes for herself and the children. In

addition she has the garden, but this she regards as part of her private domain, part of the domestic arrangements. There are both a flower garden with a small lawn on which is a flagstaff and a kitchen garden from which she keeps herself in vegetables

A House—Proud Wife

Inside the house, where Maren rules supreme, they have two living rooms, a bedroom, and a kitchen, and a room upstairs for the children. In the living rooms there are curtains, flowers on the window-sill, and decent furniture, and everything is clean and tidy. Maren is house-proud and she usually goes the round with her duster every day, even in the front room. Otherwise, this is used only when there are visitors ; on ordinary days the family occupy the room nearest the kitchen. Before the children came they used to have their meals in the kitchen and would often stay there till bed-time. But now they make themselves comfortable every evening in the living room, at least in the winter season ; in the summer they often stay in the garden till dusk. Jens will sit reading the paper or a book, except when he is making up his accounts. Maren always has some clothes to mend ; the children have their home work, or will read the weekly paper. Often one of the neighbours will call.

There is no doubt that the Hansen family is one of the happiest and most contented in Denmark. They work hard every day, but they work for themselves ; and during the last generations they and their forbears have been safe in the knowledge that they have had greater economic security than most other social groups, so long as they have farmed their land properly. As Jens Hansen usually puts it, he and Maren and the children will always get a living ; if need be, they can live on what they themselves grow, and not so badly at that. Of course, there will always be taxes and interest payments, but interest rates to the Government are governed by market conditions and so vary with the economic situation of agriculture.

It is generally said that the trend of development is against smallholdings. The use of many labour-saving machines in conjunction with tractors makes fieldwork on the small acreages of these holdings irrational. To work with a tractor is impracticable ; to work in the traditional manner with man-

and horse-power involves a disproportionate amount of labour per acre. Opponents of partitioning have obtained a number of new and striking arguments which they sometimes press to the extent of demanding that smallholdings should be merged in order to achieve optimum production units. Throughout the half century in which the Danish Government has supported the establishment of smallholdings this has been a debated point, especially since the Danish soil is so intensively cultivated that it is not possible to establish new holdings except by taking land from existing larger farms, and there are very few really large farms in Denmark. Out of a total of 208,000 agricultural holdings fewer than a thousand are of more than 300 acres, and their average is 514 acres. There is a limit to the amount of land that can be taken from these.

Jens Hansen often discusses these problems with his friend and neighbour, who has ten times as much land to his farm and who owns his own tractor. Hansen does not deny that there may be something in the arguments in favour of large-scale farming, but he never doubts for a moment that smallholdings will continue to have a future. Remember, he will say, that smallholdings have never given their owners a greater monetary return for their labour than larger farms. But they created greater production, a factor of no small importance in our country now, and their potentialities have been such that there have always been plenty of young men eager to take them on.

The essential factor, no doubt, is that since the 1880s, Denmark has enjoyed comparatively good opportunities for selling butter, bacon and eggs in foreign markets. These are the very products that smallholdings have gone in for ; the smallholder, on the whole, had just as good opportunities as the medium and large farmer in the first stage of production, the farm. Personal interest and attention pay in the feeding and management of livestock, and up to now this has never been really suitable for large-scale farming and mechanization. Jens Hansen now has a milking machine like his bigger neighbour ; and he has much less trouble about cleaning it thoroughly every day, for he does it himself.

Hansen will readily admit—and may even boast of it—that there are strict limits to his self-sufficiency ; that he would never do so well if his life were not widely based on co-operation with others. But for the smallholder societies, his holding

might never have been established, or it would have been a kind of farm worker's cottage with a quarter of its present acreage. He also has the smallholder societies to thank for the fact that the Government is so considerate of the conditions of smallholders in relation to other farmers. It is the advisory officers of his smallholder society who guide him in managing his fields and buildings.

But in day-to-day affairs also it is co-operation which sustains him ; otherwise he would not do so well compared with larger farmers. His joint ownership with his neighbour of the self-binder and its team has already been mentioned. For many years he has also been part-owner, with a dozen other smallholders and a few small farmers, of a large mobile threshing machine ; they combine to help one another after the harvest. If he is to succeed in mechanizing his holding it will be with the help of a co-operative tractor station of which he is a member ; a tractor is particularly useful for spraying against weeds, pests and diseases, but is also good to have for the autumn ploughing. Still more important is his membership of the co-operative dairy and the co-operative bacon factory. The significance of the agricultural co-operative movement to smallholders cannot be overemphasized. Jens Hansen knows that his two cans of milk and his few pigs are as well paid for as are the products of large and medium farmers, because they all have a share in the government of the co-operative and an equal voice in its affairs ; that is, one vote each. Co-operative marketing societies and co-operative purchasing societies for feeding stuffs, fertilizers, and household goods ensure that the financially weakest, the smallholders, get fair treatment. Hansen is himself a member of the management committee of the dairy. The chairman is a medium-sized farmer, though most of the members are smallholders. There are some who criticize this and think that smallholders should wield more influence in the societies and in politics. Hansen can see that there is something in this, but is not greatly concerned about it ; for the farmer who is his chairman has never, so far as he can remember, held other ideas about the management of the dairy than he has held himself.

In one of the books which Jens Hansen has on his bookshelf he has read of a professor of statistics who has written drily and impartially about the smallholder that he "is more frugal and thrifty than the wage-earner", that "his children

have a greater economic sense", and that "as a voter he is steadier and more exacting". Hansen will often look these statements up when discussing social questions, and will then give a hearty laugh and say that it is true enough, at least of Maren and her children.

It is true both of Jens Hansen and Maren and of most of the other 100,000 Danish smallholders—and the striking point about it is that they know it and can still be contented and happy.—*Danish Foreign Office Journal*, No. 10, 1954.

Extracts and Selections

NEW LIGHT ON OLD *HARIYALI*
Putting "Devil Grass" to Work

[*Hariyali, Garike, Dhoob* grass (*Cynodon dactylon* (L.) Pers.) has various names and epithets, not all of which are complimentary. In U.S.A. it is variously called Bermuda grass, Bahama grass wire, reed, salt, scutch, dog's tooth grass, devil grass, etc. It is a grass about which one speaks always with emotion or strong feelings. The lawn-maker, the cricket pitch enthusiast, the race course warden and the irrigation engineer and the soil conservationist refer to it affectionately and even call it the *ideal* grass and none better. It is the favourite forage of livestock, particularly horses which prosper on the grass.

But it is considered as a scourge and a visitation by the farmers in "black cotton soils" of Mysore; is cursed at and exterminated at great expense every few years.

It is probably the grass which annoyed the great Chanikya whose assiduity in rooting it out with his finger won the admiration of Chandragupta and led to the establishment of the Mauryan Empire.

Although it is now distributed throughout the tropics and subtropics, the best evidence points to Asia and particularly India as the home of this grass.

As in Mysore, so in many parts of America, particularly in the south-east, it was considered as a noxious weed. Only recently, on account of the great interest evinced by the farmers in these areas in livestock production and soil conservation, they have begun to realise the merits of this grass for grazing, pasture and soil binding. They are even claiming that as a plant to prevent soil erosion it is unsurpassed.

Many new varieties and strains have been developed by plant-breeders in recent years—chief among them being Coastal Bermuda, Tift Bermuda, Suwannee Bermuda (Sel 99). Coastal Bermuda is a highly productive hybrid and outstanding for both hay and pasture. Some strains are resistant to leaf-spot diseases.

Hariyali is best suited for a well-drained fertile soil—more particularly for a heavy clay, well supplied with lime and high in nitrogen. High production over a period of years—5-6 years, can be maintained with adequate applications of fertilisers—about 100 lb. of nitrogen, 120-200 lb. of phosphoric acid and 50-75 lb. of potash.

How this grass is now being put to new use for controlling erosion and in establishing permanent pastures in U.S.A. is described by Arthur Penton in an interesting article in *Organic Farming* which is reproduced here.—*Ed.*]

ONCE a pest, now a helper—that is the story of Bermuda grass. Farmers who once cursed this "devil grass" are now enjoying the profits it enables them to realise from poor or abandoned land.

Over 20,000,000 acres of land in the United States are now being deliberately planted to this grass, which farmers once grubbed out as quickly and as thoroughly as they could. Why this sudden change? Because Bermuda has been found to be an excellent base grass for permanent pastures—besides being highly useful in stabilising waterways, terrace outlet channels, steep slopes and embankments. These last uses, incidentally, are directly due to the almost unbelievable erosion-controlling ability of Bermuda grass. At the Red Plains Conservation Experiment Station at Guthrie in the south-western State of Oklahoma, over a 15-year period, run off on a steeply sloping Bermuda grass field was less than 1 per cent., and soil loss was only ·016 of a ton per acre.

Bermuda is an extremely tenacious, long-lasting perennial grass, first found in the tough growing conditions of the Bengal region of India and introduced into the United States about 1790. It produces above ground runners (stolons) that root by themselves and form the crowns of new plants at the nodes, and fleshy underground runners (rhizomes) that also develop into new plants.

Devil grass makes excellent permanent pastures on land which cannot profitably be cultivated, and permanent meadows on formerly abandoned acres. Cattle find it highly palatable, and it is high in protein, calcium and phosphoric acid. In many areas, in combination with lespedeza, ryegrass, clovers and other grasses and legumes, it gives almost year-round grazing and produces from 300-500 lb. of beef per acre, and 8,000-12,000 lb. of milk annually.

Bermuda grass is now coming into wide use throughout North Carolina, South Carolina, Louisiana, Arkansas, Texas, Oklahoma and other southern States. And new, hardy varieties may be developed soon. One hardy Bermuda, the U-3, has been found to make a fine turf grass for lawns and golf courses—it crowds out crab grass and other weeds—as far north as the

upper parts of the States of Ohio and Pennsylvania. It is now the major basic plant for building fine pastures on ground unfit for other purposes in the so-called "Cotton Belt" of the American South. It is the chief base grass east of the native grass prairies in the central and western states, and may even find wider use on those native prairies, many acres of which are in a state of depletion from overgrazing. The U.S. Soil Conservation Service estimates that when the 20,000,000 acres in direct need of it are planted to Bermuda, the total income of farmers in the region will be increased by millions of dollars yearly.

Bermuda grass can be established by seeding, sodding (putting out soil-covered chunks), or sprigging (planting dirt-free roots). Ordinary ploughing will give good chunks for sodding, and sprigs can be obtained by going over a Bermuda patch with a tandem disk, a soil pulverizer or a mulch tiller—a springtooth harrow will do the job in light sandy soils—criss-crossing the area three or four times, and using a side delivery rake to pile the root pieces up into windrews where they can be picked up easily. The roots of this grass are thickest about 4" down, so that soil should be stirred just a little deeper than that. In using a disk, a dull, jagged one is preferred to a sharp one because it pulls the roots out instead of cutting them. If the roots are not to be used immediately, it is best to store them in a cool place and wet them down.

Before planting Bermuda grass, the soil should be given a good organic treatment. Turning under one or more years of vetch or other good green manure crop—preferably a legume—will give the soil good tilth and add plenty of nitrogen and organic matter. Well in advance of planting, the farmer should test the soil, and put on the needed amounts of rock phosphate, lime and greensand, and plenty of manure—5 tons of it per acre is not too much.

Seeding especially requires good soil, and on very poor soils—where there is insufficient time to build them up with a green manure—Bermuda grass can be established satisfactorily by sodding or sprigging to insure a good stand. Fertility and good soil structure will prevent the bare "freeze-out" spots often caused by lack of moisture, close grazing and low temperatures. Once established, there is nothing better than frequent top-dressings of manure to give the best hay yields (two

tons per acre is good). And, since every ton of Bermuda hay removes about 8 lb. of phosphorus, rock phosphate too must be added occasionally.

Farmers in the midwestern States often sod Bermuda by feeding the chunks through funnel-equipped pipes rigged in front of the wheels of a wagon. The wheels firmly press each chunk into the seed-bed, which has been prepared well before planting to allow it to become firm. In North America spring is the best time for sodding and sprigging, though any season the ground has ample moisture will do. The sod chunks or sprigs should be planted in 3′ rows, spread 2-3′ apart in the row ; 8-10 bushels of sprigs are needed per acre.

Several experiment stations have developed easily-built machines for planting Bermuda grass sod and sprig. One good one, by the Oklahoma Station, combines ploughing and planting, and consists of a platform for the planter and a pipe through which the roots are dropped, falling behind the disk that opens the furrow. Two disks behind the pipe cover the roots. The same can be done with a mould-board plough. The soil should be disked afterwards to pack it more firmly—Bermuda's rhizomes and stolons are fairly hardy, but adverse weather that can cause them to dry out, freeze or mould can weaken or kill the plants. The planting should be cultivated to eliminate moisture competition from weeds, and to keep the stolons covered to allow them to crown and form new plants. These methods will insure solid cover in one season.

Seeding is the quickest, most economical method. Prepare a firm seed-bed as early in the spring as possible, well fertilized with a green manure, animal manure and rock fertilizers. Harrow it just before planting to kill off annual weeds. Because Bermuda grass has very tiny seed—over 2,000,000 per lb., hulled—only about 1 lb. is needed per acre when planted in rows, 2-3 lb. when broadcast. It may be broadcast with a wheelbarrow seeder or a cyclone hand-seeder, or row-planted (in rows 40″ apart) with a regular planter equipped with small grass seed attachments or a grass seed-drill or grain-drill equipped to plant fine seed. Plant shallow—1″ or less deep.

It may be necessary to cultivate to keep the new seeding weed-free, though light grazing after the stolons have started to run will hold down competing vegetation and encourage crowning. Discontinue in plenty of time for the plants to deve-

lop ample top-growth for winter protection. And for extra protection during their first winter, the plants should be covered with one plough furrow to each row, a couple of weeks before first frost. Then in the spring, disk and harrow the soil to bring the runners near the surface and encourage rhizome growth. Lespedeza, or any other suitable grass or legume, may be seeded into it at the same time.

For seeding in broad waterways, gullies or narrow channels, draining terraces, increase the seeding rates 50 per cent. Keep it closely cropped here for best efficiency in protecting the soil against rapid water flow. This grass also is excellent for stabilizing earth dams and spillways in making a farm pond. Wherever used, it will, alone, give 7-9 months grazing, producing its top amount of forage from May to October.

Many farmers are discovering the values of Bermuda grass in rotation with corn and other row crops, too. Sod or sprigs can be scattered between the rows of corn (or other crops that are laid by early, to give the grass a good start before winter) and covered with the last cultivation. In the Cotton Belt, Bermuda grass seed is mixed with linty cotton seed and planted with an ordinary cotton planter. Experiments have shown that corn can easily be grown on a heavy Bermuda sod with deep turning (7″). A legume growing with the Bermuda will raise yields even more.

An interesting organic fact about Bermuda grass is that a good nematode-resistant strain, like Coastal Bermuda, seems to have the power of keeping nematodes (parasitic worms) away from other plants grown with it. Lespedeza, often destroyed by root-knot nematodes in the light sandy soils of the south-eastern region of the United States, is never bothered by the disease when Coastal Bermuda is grown with it.

American farmers no longer kill Bermuda grass with chemicals. They know improved pastures mean greater food production and many farmers are pasturing one head of cattle per acre for most of the year on their new pastures of this old "weed".

TEOSINTE (*EUCHLŒNA MEXICANA* SYN. *E. LUXURIANS*) MAIZE OF GODS

[Teosinte is a native of the warmer regions of Central America and Mexico. The name is made of two Mexican words, Teo

and Zintle, meaning "Maize of Gods". It is an annual grass 8-10′ in height, cultivated in some parts of U.S.A. in the south and west. Under favourable conditions it provides heavy forage —as much as 40,000 lb. and sometimes touching 50 tons. The grass tillers profusely—20-50 stalks springing from a single root. It yields 2-3 cuttings. In Morocco, under irrigation it gives 5 cuts from middle of June to end of October. A better quality of forage and almost as high an yield may be obtained by allowing full growth and cutting but once.

The plant contains from 8-10 per cent. sugar. The leaves are long and numerous. The stalks are tender and are greedily eaten by all stalk and there is thus little waste. It is an excellent crop for preservation as silage. In U.S.A. it is planted in rows 3½-4′ apart, the distance between plants in the row being thinned to 1′. One lb. of good seed is sufficient to sow an acre. It is most successfully grown where seasons are long and the weather hot and moist.

Teosinte was introduced into Mysore by the late Dr. V. K. Badami, Economic Botanist of the State Department of Agriculture, sometime in 1930. In 1932 it was reported as "growing very well as a fodder crop during monsoon". It was multiplied and grown as a field crop and distributed to other experimental farms for preliminary trials. It was found to seed freely. In waterlogged soils the performance was poor. Dr. Badami had another object in introducing this fodder into Mysore. He wanted to cross it with sugarcane. It is also claimed that H.M. 661—a promising seedling cane of Mysore is a cross between Co 281 × Teosinte. In Coimbatore however, Dr. T. S. Venkataraman found that teosinte failed to cross with sugarcane.

Teosinte, apart from its fodder value, is of particular interest to the crop botanist. It is the nearest relative of maize which is found only in cultivation. It was for sometime believed that maize sprung from teosinte because it is so much like maize and can cross with it readily. But Mangelsdorf and Reeves, two Texas botanists, advanced a new theory in 1941 that the relationship was the other way round, that maize came first and teosinte sprung from it as a result of cross-pollination with Tripsacum grass, another relative of maize.

There is yet a third reason why teosinte is of great interest to us, *viz.*, the nutritive value of kernels for humans and bovines. The following short report from *American Agriculture* (March 25, 1953) throws interesting light on the subject.—*Ed.*]

Protein from Cereal Grass May Aid Human Nutrition

A new aid to good nutrition, especially for people who live largely on vegetable and cereal diets, may be developed from cereal grass called teosinte which grows abundantly in Central America and Mexico.

Teosinte is the closest known relative of maize. The important new fact about it, just discovered, is that it contains much more energy-building protein than corn (maize). The proteins are combinations of amino acids, which are essential constituents of all living cells and of a nourishing, body-providing diet.

Of special significance, according to nutrition experts, is the fact that it contains more than twice as much of the amino acid, methionine, as does maize. It is lack of methionine, especially, that makes the predominantly vegetable diets of people in many parts of the world insufficiently nourishing.

The discovery of teosinte's important food values was made by Dr. Irving E. Melhus, Dr. Francisco Aguirre and Dr. Novin S. Scrimshaw of Iowa State College, at Ames, Iowa. Much of their research work was done in Guatemala.

Experimental work indicates that teosinte can be crossed with maize and possibly give a hybrid of higher protein and methionine content. Five such crosses have been made and while these did not differ significantly from maize, the future crops produced from their seed are expected to show marked improvement in nourishing quality.

Teosinte kernels are smaller than corn kernels and have a hard, inedible hull. The farmers of Central America and Mexico have grown teosinte with maize for a long time, have cultivated it as cattle feed, and in some places have eaten it themselves as a maize substitute when supplies of the latter were insufficient. Until now, however, little has been known of its nutritive value.

Ground teosinte, it now appears, could be mixed with wheat or maize flours or used alone to make bread, biscuits, tortillas and other products that would add good protein to vegetable diets.

The planting of teosinte in those parts of the world where more protein-providing foods are needed and are not readily

available from meat and other sources of animal protein, could be a development of great importance, scientists believe, in helping to solve the world's food and nutrition problems.

SEED-BORNE DISEASES AND THEIR CONTROL

[There are many plant diseases which are transmitted by seeds. *Kadige roga,* the grain smut of jowar, leaf-blight or footrot of ragi (*Helminthosporium nodulosum*), leaf-spots and earhead blight of paddy (*Helminthosporium oryzæ*). Tikka disease of groundnut (*Cercospora personata*) are some of the seed-borne diseases prevalent in Mysore. A circular (No. 66) on "Treatment of seeds with fungicides" has been issued by the Mysore State Department of Agriculture and the following interesting article from *Agricultural News Letter* (AGN 409) issued by the Australian Trade Commission in India gives supplementary information relating to many other seed-borne diseases and their control. —*Ed.*]

Whereas the desirability of using good seed is universally appreciated, it is surprising that so little attention is paid to the presence of disease in what is otherwise regarded as "good" seed. The presence of a small percentage of infected seeds, even though germination is unimpaired, may be responsible for considerable losses in the subsequent crop. One or two diseased plants may be the source of an infection which spreads throughout the crop of which they are part.

The best method of avoiding seed-borne diseases is to use seed known to be free from parasitic organisms, or to grow resistant varieties. This, however, is not always possible and the treatments which have been found to be the most effective against seed-borne bacteria and fungi are—

(*a*) Dusting the seed with a fungicidal dust before planting,
(*b*) Steeping the seed in a fungicidal solution before planting, and
(*c*) Steeping the seed in water at a carefully controlled temperature.

One or other of these methods is used according to the nature of the disease to be combated. The dust treatment has the added advantage that particles of the dust are carried into the soil on the seed-coat and exert a protective action against possible parasites in the soil.

Dusts which may be used for seed treatment are copper carbonate, copper oxychloride, organic mercury compounds, and various non-metallic dusts. These are applied by placing the seed with the appropriate quantity of dust in a glass jar, or

other lidded container, and shaking vigorously for 3-4 minutes until all the seeds are thoroughly coated. Large quantities may be treated by rotating in a drum fitted with a diagonal axle. Excess dust should be screened off.

It should be remembered, however, that parasitic organisms are harboured elsewhere than in the seed. They may occur in the seed-bed or field soil, on crop refuse, in adjacent earlier planted crops, or nearby weeds, particularly those related botanically to the crop being grown. Thus crop rotation, weed control, seed-bed and field sanitation, and sometimes spraying, also need consideration.

Seed-borne parasites may be carried on in the seed or merely with it, on pieces of dead plant tissue or, in the case of fungi, as resting bodies. The reason for their being overlooked so commonly is probably that they rarely have any immediate effect on the germination but multiply on the seedlings as they develop. In the case of the head smuts of cereals, such as bunt of wheat, loose smut of wheat and the smuts of oats and barley, the seed-borne parasites grow up inside the developing plants without causing any visible injury until the heads emerge and are seen to be smutted. In this way seed, which appears plump and clean and which appears healthy for many weeks, may actually be responsible for serious loss. This emphasises the point that the value of a seed sample cannot be accurately assessed from its appearance.

The most satisfactory method of controlling the smut diseases of cereals is to use resistant varieties. Unfortunately, except in the case of flag smut of wheat, the varieties in use at present do not show such resistance. Therefore, seed should be used which has come from a clean crop in the vicinity of which no diseased crops were grown. Seed wheat which is heavily infected with bunt spores, however, can be readily disinfected by the use of fungicidal dusts. Hexachlor-benzene has shown itself to be outstanding for this purpose, but copper carbonate and organic mercury compounds are also very effective. The oat smuts can be controlled by steeping the seed in or damping it with formalin, and infection can be much reduced with dusts.

An outstanding example of the importance of seed-borne diseases is to be found in that familiar vegetable crop, the bean. The most important seed-borne diseases of French beans are various bacterial blights, anthracnose, which is a fungous

disease, and mosaic, a virus disease. Until about ten years ago the bean seed available in New South Wales was heavily infected with these destructive diseases, and it was realised that, if losses were to be overcome, disease-free seed would have to be obtained, as no effective and practicable methods of seed treatment were known for beans. It had previously been shown in California, that when bean seed was produced in areas where the average rainfall during the growing period was less than 1" and only furrow irrigation was practised, disease-free seed is produced. No suitable areas of this type exist in New South Wales, but it has been found that, if seed is grown in high rainfall areas such as the south coast, diseases can be detected easily and the seed crops pronounced free from disease with confidence. Operating on this basis a satisfactory certification scheme has been developed which now provides clean bean seed of susceptible varieties and losses have been considerably reduced.

A well-known case of a disease being transmitted with the seed, but not actually on it or in it, is that of ergot of paspalum. The fungus which causes this disease infects the paspalum flowers and prevents seed-formation. Within infected flowers, however, small hard bodies composed of fungus tissue develop. These are little larger than the paspalum seeds and are collected with the seed during harvesting operations and, unless the seed is thoroughly cleaned, are sown with it. From these bodies spores develop which blow about and cause new infections. Diseases such as this are not seed-borne in the strict sense, but for practical purposes are included in this group.

Certain important bacterial and fungus diseases of crucifers and tomatoes are seed-borne. Unless the seed is known to have originated from healthy plants or to have been treated, growers are advised to steep the seed in warm water. If the treatment is carried out at the correct temperature and for the correct length of time the parasites will be killed and the seed left unharmed.

In the case of crucifers the seed should be tied loosely, $\frac{1}{4}$ lb. at a time, in cheese cloth bags and suspended in 3 or 4 gallons of water previously heated to 122° F. (or 50° C.). After treatment, quickly spread out the seed to dry in the shade. A kerosene tin provided with a wooden lid in which two holes are bored, one for the thermometer and the other for a stirring

stick, is a convenient apparatus for the warm water treatment. The temperature may be maintained by means of a small flame, or the tin may be insulated by packing in a box of straw and the correct temperature obtained by first pouring in boiling and then cold water.

Cabbage seed should be treated for 25 minutes ; with seed of all other crucifers, 18 minutes' treatment will be sufficient.

Onion seed is treated the same way as cabbage, tomato seed similarly but for 30 minutes, and celery for 30 minutes at 118° F. The treatment in the case of celery seed is to control late blight. In this case, however, if the seed is more than two years old the treatment is not necessary, as the fungus will have died out.

News & Announcements

Prof. P. C. Sarbadhikari

We are indebted to *Nature* (**173**, 615, April 3, 1954), for the following obituary notice.

Dr. P. C. Sarbadhikari, the well-known Indian Cytologist, who died on December 27 in his fifty-sixth year, was Professor of Botany and Head of the Botanical Department of the University of Calcutta. As a young man he studied under the late Sir John Farmer at the Imperial College of Science and Technology, London, and obtained the D.Sc. of the University of London for a series of researches in the cytology of *Osmunda* and *Doodia*. He also studied for shorter periods at Wisley, Kew, Merton, Berlin-Dahlemand and at the University of Paris under Prof. Guilliermond. In 1925 he was appointed Lecturer in botany at the University College, Colombo, and later became Professor there. In 1947 he went to Calcutta to the post which he occupied at the time of his death.

Prof. Sarbadhikari was author of numerous papers on a variety of botanical topics. His chief contributions lay in the field of morphology and cytology. Specially notable are his researches on the cytology of apogamy and apospory in ferns. A man of considerable culture, he did much to develop botanical study and research in India.

Sir James Scott Watson and Prof. H. G. Garner

Prof. H. G. Garner is to succeed Sir James Scott Watson as Chief Scientific and Agricultural Adviser to the Ministry of Agriculture and Director-General of the National Agricultural Advisory Service in U.K. on December 31st of this year. Prof. Garner is at present Professor of Agriculture at the University of Reading. Born in 1898, he studied agriculture at Cambridge. He was on the staff of the Animal Nutrition Institute for some time and later taught in the School of Agriculture, Cambridge. In 1944, he became Professor at Reading. His excellent *Outline of Crop Husbandry* is a standard text.

Sir James Scott Watson has had a varied career. He studied at Edinburgh, Berlin and Iowa. He taught at Edinburgh and Oxford. For three years during the war he was the Agricultural Attache to the British Embassy at Washington. Since 1948 he has been holding the present post. His text-book on agriculture known to generations of agricultural students as Watson and Moore is deservedly famous and popular throughout the world. He launched and organised the U.K. National Agricultural Advisory Service in 1946.

David Milne, C.I.E.

Death is reported of Mr. David Milne, I.A.S., who was Director of Agriculture in the Punjab from 1922 to 1933. He was mainly responsible for the evolution of the famous Punjab-American Cotton strains like 4 F and 284 F. It was as a result of his work that American upland cottons of long staple came to be cultivated over large areas in the Punjab and Sind. Born in 1876 in Scotland, he graduated from Aberdeen. He was for sometime Agricultural Chemist in Egypt and joined the Indian Agricultural Service in 1907. He is the author of that popular *Handbook of Field and Garden Crops* in the Punjab.

New Fellows of the National Institute of Sciences of India

Among those who have been recently elected Fellows are Dr. B. C. Basu, Research Officer in Entomology, Indian Veterinary Research Institute, Dr. Zal R. Kothawala, former Director of Dairy Research, Bangalore, Dr. L. S. S. Kumar, Principal, Poona College of Agriculture, and Dr. S. M. Sircar, Lecturer in Botany, University of Calcutta.

Indo-Pacific Fisheries Council

The Fifth Meeting of the Council was held in Bangkok from January 22 to February 5, 1954. Thirteen out of the sixteen

countries of South-East Asia attended the session. The Indian delegation was led by Dr. N. K. Pannikar, Chief of the Central Marine Fisheries Research Station at Mandapam.

The next session is proposed to be held in October 1955 at Tokyo.—*Curr. Sci.*, 22 (3), 73-109, Mar. 1954.

International Congress of Botany

THE EIGHTH INTERNATIONAL CONGRESS OF BOTANY will be held in Paris from July 2-14 this year.

The Indian delegation will be led by Dr. B. P. Pal, Director, Indian Agricultural Research Institute. The other members deputed by the Government of India are Dr. P. Maheshwari of the Delhi University, Prof. K. N. Kaul, Director of National Botanic Gardens, Lucknow, and Dr. K. A. Chowdhury, Forest Research Institute, Dehra Dun.

International Congress of Zoology

THE FIFTEENTH INTERNATIONAL ZOOLOGICAL CONGRESS is to be held in 1958 in London under the Presidentship of Dr. G. R. De Beer. The Fourteenth Congress was held last August at Copenhagen.

Commonwealth Entomological Conference

THE SIXTH CONFERENCE will be held from July 7 to 9 of this year in London. Among the subjects for the session are (1) the effect of insecticides and other chemicals on the balance of animal population, (2) the development of resistance to insecticides, (3) the estimation of losses from pests, (4) the biological control of insects and weeds, (5) pests of tropical cereal crops, (6) developments in work on pests of stored products, etc.

The last conference was held nearly six years ago.

Research Notes and News

Sugarcane Ratoons

N. V. MOHANA RAO AND R. L. NARASIMHAM from Anakapalle Sugarcane Research Station have given a short resume of their investigation [*Curr. Sci.*, 23 (3) 95, March 1954] regarding the performance of Co 419 as a plant crop and in the first two ratoons. The yield of the first ratoon could be pulled up to the level of the plant crop by increasing the nitrogen application

by 50 per cent. but no similar response to nitrogen was observed in the second ratoon. However application of phosphates showed a slight benefit when response to nitrogen was limited as in the second ratoon. The ratoons attained maturity earlier and recorded better juice quality. Foliar and whole plant analysis showed a higher nutritional level in respect of nitrogen in the plant crop than in the ratoon. A higher nitrogen uptake was also observed. The ratoons showed a lower hydration of the plant tissue than the plant crop and the investigators think that this may induce earlier maturity in ratoons.

Riboflavin in Sprouting Bengal Gram (*Cicer arietinum*)

Sprouted Bengalgram is often suggested as a good breakfast food on account of diastase and other enzymes which are present in them. M. S. Naik and N. Narayana from the Poona College of Agriculture have reported (*Curr. Sci.*, **23** (4), 123-24, April 1954) on another nutritional aspect of sprouting gram. Riboflavin (vitamin B_2) synthesis goes on increasing up to the fourth or fifth day. Plants grown in the dark have more riboflavin than those grown in light. It is concentrated more in the germ than in the cotyledon. If the germ is removed, the remaining portion of the seed cannot synthesise riboflavin to the same extent.

Inducement of Parthenocarpy by 2, 4-D and Urine

In the same issue of the Journal referred to above, S. Krishnamurthi and D. Subramanian from Annamalai University, have referred to their experiment with 2, 4-D (a popular hormone weed-killer in U.S.A.) for inducing parthenocarpy (formation of fruit without fertilisation resulting in seedlessness) in brinjal (*Solanum melongena* L.). Their main findings are : (1) All the treatments with 2, 4-D induced 100 per cent. parthenocarpy in all fruits, (2) All the treatments showed increased fruitset over the control—particularly high if applied as paste in 0·0025 per cent. concentration, (3) total yield showed a significant increase over the control in spite of lower weight and volume of parthenocarpic fruits, (4) the fruits matured earlier with the treatment by 2-9 days, (5) The thickness of the exocarp induced by the treatment does not affect the quality of the fruits.

A. Kumar and A. K. Rajan, working in the College of Agriculture, Banaras Hindu University, experimented with spraying cow, buffalo and bull urine in concentrations of 1 in 300 to

2,000 for inducing parthenocarpy in tomato and chillies. They found that weaker doses of cow urine appear to be more effective than the others in fruit production in the case of tomatoes. In chillies there is response to all the three urines in concentrations of 1 in 300. Would these results be taken as one more addition to the armoury of those who extol the virtues of *Panchagavya* (a concoction of urine, dung, milk, ghee and curds from the cow).

Correspondence

Re: Use of Folidol 605 against Kannada (Josmine) mites.

I HAVE over 8,000 plants of Kakada and was sustaining losses year after year for the last fifteen years due to severe attack of mites. I came to know from the District Horticultural Inspector, Bangalore, that there is a German preparation which could be tried for this trouble and I immediately contacted Messrs. Rangaswamy & Co., 5th Main Road, Gandhinagar, Bangalore-2, from whom I bought Folidol E 605 and sprayed in a concentration of 1 c.c. per gallon. I gave three applications in an interval of 10 days and now it is two months and the plants doubled themselves with alround new flushes and the new flushes are completely free from mite attack. The damage caused by mite attack is popularly known as *Maggigeroga* (ಮುಜ್ಜಿಗೆ ರೋಗ). I request you to publish this note in your esteemed journal so that the other co-cultivators may derive benefit.

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